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Item 5 (b) of the provisional agenda

Initial work programme of the Platform: guides on assessments, policy support tools and methodologies, and preliminary guides on scenario analysis and modelling and the conceptualization of values

Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services (deliverable 3 (d))

Note by the Secretariat

At the second session of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, held in Antalya, Turkey, from 9 to 14 December 2013, member States approved the initiation of scoping for a methodological assessment on the conceptualization of values of biodiversity and nature's benefits to people and the development of a preliminary guide, for consideration by the Plenary at its third session. In response to that request, the Multidisciplinary Expert Panel and the Bureau selected experts from a pool nominated by Governments and stakeholders. Two expert workshops were held, the first in Siegburg, Germany, from 2 to 5 July 2014 and the second in Bonn, Germany, from 8 to 12 September 2014, to develop both the scoping document, in accordance with the procedures for the preparation of the Platform's deliverables as set out in the annex to decision IPBES-2/3, and the preliminary guide for the methodological assessment. The scoping document (IPBES/3/8) is submitted to the Plenary for consideration at its third session. Section I of the annex to the present note sets out the list of selected experts who attended the workshops and drafted the scoping document and the guide and the list of experts who reviewed them. Section II sets out the preliminary guide. The annex has not been formally edited.

Annex

I. List of experts and reviewers

1. Members of the IPBES Multidisciplinary Expert Panel and Bureau

Sandra Myrna Díaz - Member of the Multidisciplinary Expert Panel and expert group co-chair
György Pataki (Hungary) – Member of the Multidisciplinary Expert Panel and expert group co-chair
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Robert T. Watson (United Kingdom) – Bureau member and expert group co-chair
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2. Selected Experts

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3. Expert reviewers

Edward B. Barbier (University of Wyoming), Michael Burton (University of Western Australia), Joël Houdet (ACTS, Integrated Sustainability Services, Synergiz), Hans Keune (Belgian Biodiversity Platform & Research Institute for Nature and Forest), Shuang Liu (CSIRO Land and Water Flagship), Simone Maynard (Simone Maynard Consulting), Rosimeiry Portela (Conservation International), Marja Spierenburg (VU University Amsterdam)

II. Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services

Chapter 1: Introduction

The second session of the IPBES Plenary approved "*the initiation of scoping for a methodological assessment on the conceptualization of values of biodiversity and nature's benefit to people and development of a preliminary guide, for consideration by the plenary at its third session*" (IPBES/2/17, Annex V).

This guide is Platform supporting material categorized as a guidance document (IPBES/2/17, Annex to decision IPBES-2/3, section 5d) "that assists in the preparation of comprehensive and scientifically, technically and socio-economically sound Platform reports and technical papers". The preparation of guidance material is overseen by the Multidisciplinary Expert Panel and is commissioned by the Plenary.

This guide is about the diverse conceptualization of multiple values of nature and its benefits. It aims to pinpoint these multiple values to align the methodologies for future qualitative and quantitative assessments of values of nature and its benefits, including biodiversity and ecosystem functions and services for implementation in Platform work programme 2014-2018, notably objectives 2 and 3. The purpose of the guide is to ensure consistency in approach across IPBES assessments of biodiversity and ecosystem functions and services undertaken in accordance with the IPBES conceptual framework.

The IPBES conceptual framework acknowledges the different paradigms/world views guiding the human expressions of value and aims to integrate definitions, classification of biodiversity and stakeholders, concepts and valuation methodologies as well as culturally rooted success criteria within this broader framework. Figure 1 provides a schematic of the guide and how it addresses the IPBES conceptual framework.

Value is a term used to describe human preferences and judgment for ecosystem functions and services. Values, which are multiple and plural, may be formed and elicited within different cultural, social and institutional frameworks - all with the purpose of social and economic knowledge informing policy decisions.

This guide addresses six key issues: (i) major concepts; (ii) valuation methodologies; (iii) data and knowledge needs; (iv) integrating into IPBES activities; (v) capacity building; and (vi) policy support tools – corresponding to chapters 2-7.

Chapters 2 and 3 integrate existing knowledge on the diverse conceptualization of multiple values of nature and its benefits. Chapter 2 provides guidance on types of values related to nature and its benefits from diverse cultural perspectives. Chapter 3 summarizes five broad types of valuation methodologies and sets out a protocol for conducting both valuation studies and assessments of such valuation studies. These two chapters synthesize and critically review the literature in new ways to correspond to the IPBES conceptual framework and support the entire IPBES work programme at a unique science-policy interface. Chapters 4-7 aim to demonstrate the different needs (including data and knowledge, capacity building) of an IPBES approach to the multiple values and valuation methodologies for targeted assessments. They also consider potential ways of supporting policy and how valuation could be integrated into the IPBES thematic, regional/sub-regional and global assessments.

Figure 1: Schematic of the guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services.

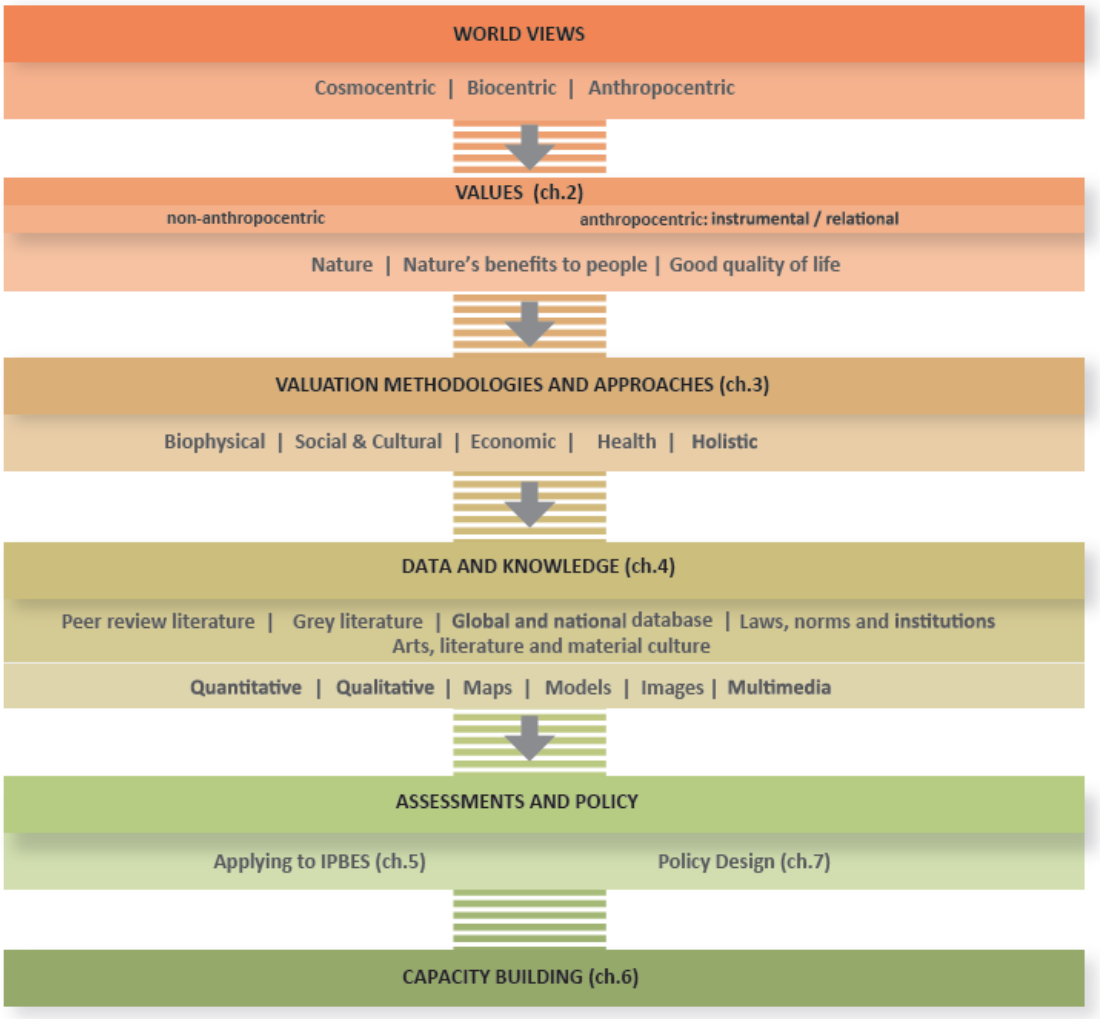

Figure legend: the different sets of rows show the different types of world views, values and foci of value, valuation methodologies and approaches, data sources, and data types. The choice of a particular world view can be associated to various types of value and relate to all the foci of value, for which particular approaches, data sources and data types are needed. The large number of possible combinations is represented here by a generic arrow linking the different sets of rows.

Figure 1 shows a schematic of this guide. The interdependency of the different layers fits with the IPBES Conceptual Framework. The implicit connections between the fields of study as well as their different theoretical underpinnings are further developed in chapter 2. It shows the inclusive delimitation of the guide and acknowledges the broad perspectives present in this guide. It also aims to make it easier to develop the science-policy interface from very different scientific disciplines.

Chapter 2: Major concepts of values

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2.1. The purpose of understanding values

The concept of "value" has multiple meanings. The word can refer to the mere measurement of quantifiable attributes, like when someone tells that the *value* of species richness of this landscape is x amount of species. Monetary values are values in this meaning when stating that the *value* of this ecosystem service is worth x amount of money. The word "value" can also refers to values conceived as an inherent property of an entity or a state of the world, independent of any external recognition by people. Inherent values of nature have this meaning. The concept of value also refers to the adherence to rules and moral judgments. Pursuing environmental justice has this meaning. Finally, values can be conceived as the importance people attribute to an entity, to a relation or a state of the world, or to the contribution of an action towards user specified goals, objectives or conditions. *These values influence human thought and emotion, stimulate expression, and motivate behavior and actions.*

Plural values on a similar entity can exist at the same time at different scales, and can dynamically evolve over time. For instance a landscape can be seen as a good site for mineral exploitation, a sacred space, a provider of food and medicine, important for carbon sequestration and water regulation, and the like. These values might change as the overall preferences for nature between between different stakeholders and within similar stakeholders change over time and contexts. This may be due to changes in social or ecological conditions, or access to new information. The interaction of values between different agents can result in various outcomes that can have implications for conservation, equity, resilience and broad sustainability goals.
Understanding how values are conceptualized and formed, how they change across contexts and scales and over time, and how the different types of values are taken into account is critical to inform decision-making and policy design at local to national and global contexts. This is addressed in the following sections as a necessary background to choosing the most appropriate valuation methodologies.

2.2. Conceptualization of values

The typology of values used in this chapter and examples of them are presented in table 2.1. The table guides the user through the key concepts and definitions used for the conceptualization of values. It is also intended to guide the assessment of values at stake within IPBES activities, as well as for a range of issues related to conservation and sustainable use of biodiversity, long-term human well-being and sustainable development. It represents a range of values (non-exhaustive) that could arise from very different worldviews. The table is consistent with the three broad categories within the IPBES conceptual framework (nature, nature´s benefits to people, good quality of life) and expands
from it for value identification and assessment. This division between "nature", "nature's benefits to people" and "good quality of life" has been chosen for pragmatic reasons and is not meant to describe an ontological division of the world in three separated realms. To convey this idea, the corresponding cells in the table are separated by broken lines.

The table aims to be as inclusive as possible in order to encompass the different lenses through which values could be seen. However, it also tries to provide a framework simple enough to be useful for practitioners. The last column, in particular, only presents few illustrative examples of the kinds of valuable entities, processes or states of the world that could be relevant in specific situations. Furthermore, since the different foci of values may occur concurrently, there is some overlap and redundancy among the key elements and examples. Here the purpose has not been to avoid double-counting but rather to try to be as inclusive as possible. Given the plurality of worldviews and approaches to valuation, the table is necessarily referential, heterogeneous, and non-prescriptive. The examples given include what may be valued as well as how these values may be expressed and manifested within society. It includes both expressions of value preferences (e.g. a landscape may be considered as sacred or of touristic value or of production value) and measures of what is valued (e.g. cultural heritage, economic potential, biological uniqueness).

Table 2.1. Values related to nature, nature's benefits and a good quality of life. This table aims to be inclusive of the different approaches and perspectives on valuation related to nature, nature's benefits and good quality of life. The use of different targets of valuation help the users of the table find the terms used within different conceptual backgrounds that may be related (e.g. biophysical assemblages and biodiversity; or biosphere's ability to enable human endeavor and nature's goods and services). The examples of key 'things' of value are heterogeneous to represent the wide range of approaches used. The table is neither exclusive nor exhaustive.

Focus of values	Types of values		Key targets of valuation	Examples of key 'things' of value
NATURE *Intrinsic value*	**Non-anthropocentric**		Individual organisms	Living beings (biocentrism), sentient beings (animal welfare/rights)...
			Biophysical assemblages	Populations, communities, ecosystems, biomes, the biosphere, Gaia, Pachamama, Mother Earth...
			Biophysical processes	Evolution, ecosystem functions and processes, ecological resilience ...
			Biodiversity	Genetic, functional, taxonomic and phylogenetic diversity, uniqueness, vulnerability...
NATURE'S BENEFITS TO PEOPLE	**Anthropocentric**	*Instrumental*	Biosphere's ability to enable human endeavour	Energy: Embodied energy, Human Appropriation of Net Primary Production (HANPP)...
				Materials: Total material consumption, life cycles, carbon footprint, water footprint...
				Land: Land cover flows, ecological footprint...
			Nature's ability to supply benefits (basis of benefits)	Habitats for fisheries, contribution of soil biodiversity to sustenance of long-term yields,...
			Nature's gifts, goods and services (actual services enjoyed)	Regulating: Climate regulation, regulation of water flows, pollination, biological control...
				Provisioning: Food, medicine, timber, water, bioenergy...
				Cultural: Ecotourism, education, psychological benefits, bequest value, ...

Focus of values	Types of values		Key targets of valuation	Examples of key 'things' of value
GOOD QUALITY OF LIFE		*Relational*	Security and Livelihoods	Physical security, political stability, food and water security, energy security, livelihood security...
			Sustainability and Resilience	Social-ecological resilience, social, economic and ecological sustainability...
			Diversity and Options	Biocultural diversity, diversity of current and future options …
			Living well in harmony with nature and Mother Earth	Stewardship, relationships and interactions between people and nature inherently entwined as systems of life, as also indicated by time spent for managing ecosystems, conservation activities, contemplation of nature...
			Health and Wellbeing	Physical, mental, holistic health, biophilia...
			Education and Knowledge	Inspiration, education, experience, learning space...
			Identity and Autonomy	Sense of place, sense of community, historical values, agency, self-determination...
			Good social relations	Community cohesion, social resilience, conviviality...
			Art and Cultural heritage	Inspiration, artistic creation...
			Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…
			Governance and Justice	Environmental justice, intra-generational equity, inter-generational equity...
Note: Any given 'thing' of value can contribute (in some way) to multiple types of value, depending on the perspectives of people involved. For example, snow leopards can be valued intrinsically as sentient beings, they can be valued instrumentally for their contribution to ecosystem's resilience, and appropriate treatment of snow leopards can be judged via relational values.				

2.2.1. Different worldviews

Different paradigms and worldviews strongly influence valuation and its consequences on policy design/implementation and decision-making. Many values are culturally constructed and contextualized (Brondízio *et al.*, 2010) and thus depend heavilyon the different understandings, beliefs, norms and rights shared or disputed by individuals and societies.

There is a huge diversity of representations of the connections between human beings and nature. One extreme of a spectrum of positions could be a narrowly instrumental conception of nature. Some people see nature as mainly a provider of goods and services that can be substituted provided the appropriate technological power. This can be defined as strong anthropocentrism (Norton (1986)) . Others, while still attributing a privilege to human beings over the rest of nature, will emphasize the non-consumptive and non-use values of nature and the moral significance of good relationships with natural entities. This is often referred to as weak anthropocentrism (Norton, 1986). On the other side of the spectrum, some people believe that all living beings deserve a direct moral respect (biocentric worldviews as in (Taylor, 1986)) or that human beings are an organic part of nature belonging to an interconnected system of life (ecocentric or cosmocentric worldviews). Here, the principle of stewardship over nature is emphasized, the rights of Mother Earth and its reliance on reciprocity are emphasized (Pacheco, 2014).

2.2.2. Different foci of value

Values mirrored in the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development relate to a great variety of different "things" (issues, natural entities and functions). Sometimes, the concerns are about the values of ***nature*** or natural entities for themselves, mainly focusing on their ecological state or attributing them a moral value, like the view that species should not be driven to extinction independently of the consequences of such extinction for human well-being. Sometimes, the concerns are also about the ***benefits*** in the broadest sense that people draw from nature or ecosystem functioning, for example, the values of ecosystem services. Finally, the concerns are about the contribution of nature and ecosystem functioning to the ***good quality of life***, for instance landscape conservation contributes to the sense of place of a community.

It must be acknowledged that any firm distinction between human beings and the rest of the world is a historically and culturally situated way to view "nature" (Descola, 2013). This means that there are different peoples' visions, approaches, and worldviews that underpin the ways to consider and value "nature", and that the very idea of "nature" or "Mother Earth" are culture-specific. The arbitrary division used here was chosen for practical purposes, and can be used as long as caution is exercised on its partiality. It is imperative not to treat the division as objectively true and strict when confronted with different or heterogeneous representations.

2.2.3. The concept of "nature"

The concept of "nature", as used in Table 2.1, refers to nature at large, encompassing a continuum from nature as wilderness to nature as domesticated plants and animals. Since it is widely argued that we have now entered an era in which the whole planet is influenced by human activities, it seems impossible to focus on a nature completely free from human influence.

Values attributed to nature also often concern some portions of nature (e.g. agricultural landscapes) or some natural entities (e.g. pet species) that have been influenced by human activities to different degrees. All of these components of nature are included in the scope of the table. However, some controversial issues can be raised about whether some highly technologically dependent entities (such as GMOs or clones) belong to nature or not. Such inclusion will depend on how people view the nature/culture boundary and define the concept of "nature" itself. It is, however, outside the scope of this document, and even outside of the legitimacy of its authors, to decide in any strict sense what nature is or is not as this will depend on the cultural context defining the term. This plasticity concerning the concept of nature should be kept in mind by anyone using this table or engaged in values assessment.

2.2.4. Different types of values

The concept of "***intrinsic value***" can refer to inherent value, i.e. the value something has independent of any human experience or evaluation. Such a value is viewed as an inherent property of the entity and not ascribed or generated by external valuing agents (such as human beings). This is the meaning of intrinsic value that has been adopted in the IPBES Conceptual Framework (Díaz *et al.*, In Press): "*Intrinsic value* [is] *the value inherent to nature, independent of human experience and evaluation and thus beyond the scope of anthropocentric valuation approaches*". Since this type of value can only be recognized by humans but not assessed in a valuation process, the term "intrinsic value" appears under "Nature" but it is not the target of any valuation process[1].

Among the values held by human beings, values can be classified in terms of their main foci, depending on whether they are targeted at human ends or not.

Non-anthropocentric values are values not exclusively centered on humans. For instance, cosmocentric or biocentric values are non-anthropocentric since they relate to the cosmos as a whole or to living beings in general rather than only to human beings. The values that people attribute to animals, living beings, species or Mother Earth for themselves, without any regard for their contribution to human well-being, are thus told to be non-anthropocentric.

Anthropocentric values are values centered on humans. In the table, the values ascribed to nature's benefits to people and nature's contributions to a good quality of life for human beings are anthropocentric, since they are ultimately related to proper human ends.

Anthropocentric values can in turn be classified with respect to how they relate to human ends. ***Instrumental values*** are the values attributed to things as they are seen as means to achieve another end than themselves. In the table, the nature's gifts, goods and services are valued as means for human ends. For example, food and medicine are means to live a flourishing life.

[1] In the scientific literature, the concept of "intrinsic value" sometimes refer to the value ascribed to something for its own sake, without any regard to its utility for other ends than itself, that is non-instrumental value. Such non-instrumental values need not to be inherent as it can be ascribed by an external valuating agent (i.e. human beings). This means that although such values are held by humans, they are not centered on human interests. These values are crucial for valuation processes and appear in the table within the category titled Nature as non-anthopocentric values.

Relational values can be understood as a type of value attributed to a particular kind of interaction. Within the IPBES conceptual framework, relational value has been described as the positive value ascribed to "*desirable relationships, such as those among people and between people and nature, as in the notion of "living in harmony with nature" or "living-well in balance and harmony with Mother Earth*". In this way, relational values refer to both desirable human-human interactions and human-nature interactions. For example, living in harmony with nature is a desirable property of the society, nature and its interactions. As such, they can be seen as a type of value that is present both when the focus of a valuation is directed towards good quality of life and nature's benefits to people. The use of "relational value" here is consistent with the approach adopted in the conceptual framework[2].

Note that there are no clear limits between value types, and instead, sometimes the same use or enjoyment of nature can be related with different categories of values. Hence, for example the diversity of maize landraces is an instrumental value as a provision of germplasm for higher yields or pest resistance. This diversity is also relational as it relates to a sense of identity and heritage. Such 'overlaps' may be considered as reinforcing the multiple values that people associate with biodiversity and ecosystems.

2.2.5. Pluralism

Since worldviews, focus of valuation and values are so diverse, values assessments need to be adjusted to the specific contexts when considering the values of nature, nature's benefits and a good quality of life.

This pluralism in approaches and methods should be sensitive to different dimensions of the plurality of values. It can refer to how values change across different people and different cultures. It can refer to the way they change across space and time. It can also refer to how values change for a single person, in a specific moment and place, depending on the perspective used.

All values cannot be reduced to a single metric. For instance, a mountain may be regarded as a mineral deposit with high economic potential by one set of actors, whilst at the same time valued as the guardian of an ethnic race by other actors. While the former focus of value can be captured using quantitative opportunity cost methods, the latter can be captured only through qualitative/ socio-cultural methods. Furthermore, it might not be possible to integrate the different values understood and measured in different dimensions.

Different value systems can be complementary but harmonization may not always be possible. Mismatches in the context of valuation often occur. Contradiction and conflict between different systems of value (e.g. between rights-based approaches and human needs-based approaches) are particularly relevant to decision-making. Some approaches will emphasize the quantification of biophysical and ecological attributes of nature, others can focus on the physical, cultural and socio-psychological benefits from nature, while others can address the moral values that influence what is meant by a "good quality of life" (Brennan and Lo, 2011).

The approach to valuation is thus dependent on the particular way of thinking and the perspectives on the way people see and manage their relation and interaction with nature (Brondízio *et al.*, 2010). In order to encompass the great range of worldviews and values, there is a need to use a range of approaches to valuation derived from a variety of disciplines and knowledge systems (e.g. indigenous knowledge systems). It is also crucial to choose the methods that are appropriate in the valuation context (see Chapter 3).

2.3. Changes in values across time, space, and social organization scales

Worldviews, values and perceptions are not absolute or static and change over time (i.e. past, future years, decades, millennia), space (i.e. local, regional, national, global) and social-organization (i.e. individual,

[2] Within certain philosophical frameworks, all values may be understood as having a relational character. That is, that all values either stem from interactions and/or that all entities are interrelated and co-produced. This can, for example be the case in worldviews in which nature and culture are seen to be inherently entwined, and/or within virtue ethics frameworks, in which assessments of what is good and bad focus on the particular attitude adopted in relation to a particular context.

local, global communities). As value related decisions change both across and within these three dimensions, mismatches of scale represent a core challenge in perceiving values (Duraiappah *et al.*, 2014).

2.3.1. Time scale

Perception of time is relevant to values and valuation, whether short versus long or past versus future,. Some will value more the short term while others will value more the long term. In economic decision making, how much future value decreases with respect to current value depends on the time preference for consumption (today or into the future) and whether it is in the short or the longer term. Conversely, increased ecological value into the future can be expected from the restoration of an ecosystem.

Perception of time also plays a role in understanding cultural perspectives, where relationships with the past or future may have implications for decision making. Many cultures maintain strong relationships with ancestors and historic events, and envision futures transcending multiple generations.

2.3.2. Spatial scale

Spatial scale anchors value perceptions (close proximity or far distance; fine or coarse resolution i.e. of square meters to thousands of kilometres). The values of nature, nature's benefits to people and a good quality of life change across space (Costanza, 2008). These changes are given by the dynamics of the biophysical and societal characteristics of the unit of analysis, by changes in flows to and from the unit of analysis, changes in movements of those linked to such unit, or changes in the foci of the analysis within this unit.

Managing organisms and ecosystems to attain "conservation and sustainable use of biodiversity, long-term human well-being and sustainable development", as stated in the IPBES goal, requires the use of an appropriate scale. The choice of scale depends on understanding the supply of nature's benefits to people (determined by ecological functions, drivers, processes and interactions) as well as the societal demand/need for these benefits. The perceived shortage or abundance of various benefits to people can be expressed as the gap between supply and demand/need. This gap varies for all benefits resulting in trade-offs between benefits. How individuals or communities perceive abundance or shortage of these benefits across multiple spatial scales – which is determined by the values they give to nature, nature's benefits and good quality of life – ultimately governs the ability of the ecosystems to deliver benefits and sustain biodiversity at subsequently higher and broader spatial scales.

2.3.3. Social-organization scale

Nature's valuation should reflect values emerging at different levels of societal organization, from individuals, to communities, to societies at large. Societal configurations express their demands or needs for nature's benefits in diverse ways. Values are rooted in particular worldviews and perceptions but are also constructed during the valuation process itself and in dialogue with others.

For example, the values we express as consumers making choices based on individual preferences are very different from the values we express as citizens to influence political decisions at an aggregated societal level (Sagoff, 1998). Values held by individuals, as is the case of many provisioning ecosystem services, relate clearly to those of nature's benefits that have private character.

However, shared values are particularly relevant for nature's benefits that exhibit common or public character, such as applies with most regulating and cultural services, and for most of relational values.

At the community level, group deliberation can be used for valuation. Deliberation allows people to learn about the implications of alternative courses of actions on nature's benefit to society and other people's quality of life, and as a consequence reconsider their initial value positions (Vatn, 2009). When addressing values at different social-organization scales, such as nations, where deliberation by small groups may not represent the values of society at large, it can be useful to instead look at values embedded in societal norms, conventions and legally sanctioned rules. For example, constitutions permeated by the values of indigenous peoples in societies like Bolivia, Ecuador and New Zealand incorporate formal recognition of rights to nature. Ecuador has declared its biodiversity and natural resources as common assets not subject to private appropriation.

Individual and group-based valuations are not necessarily mutually exclusive and may provide complementary information with regard to how values are expressed at different levels of societal organization. Property rights are one example of how different cultures and nations emphasize the liberty of people as individuals (e.g. private property rights), or the collective rights and responsibilities of groups (e.g. public property rights). Shared values and responsibilities are especially prevalent where ecosystems become legal entities with intrinsic rights (e.g. Whanganui River in New Zealand (Good, 2013) and have a common property dimension (e.g. common assets, including the regulating and supporting functions of ecosystems).

Table 2.1. illustrates the three interacting dimensions of scale, space, time and social organization, and the changes encompassed by the value of nature, nature's benefits and a good life across these scales. For example, at the local, short term scale values for individuals/families center on how to secure their livelihoods. Moving along the time and space scales, the spiritual and cultural values of ethnic groups have developed at subnational spatial scales over decades or centuries. At the highest level most basic intrinsic values can be shared across social contexts. Life on earth results from long-term evolution across the planet.

Distinctions of scale create a context for how people conceptualize, formulate, articulate and (knowingly or unknowingly) allocate value to nature, nature's benefits and a good quality of life. The value choice to consider at any particular space and time is often influenced by the presence of socio-cultural norms, institutions, notions of rights and responsibility for nature and access to its benefits.

2.4. Formation and dynamics of values

A range of psychological, cognitive, social, cultural and political processes influence how values are generated and articulated, across different social and cultural contexts and worldviews. Some social psychologists argue that values form interrelated sets or value systems, with some values at the center (core values, relatively stable over time). Their research suggests that core values – such as achievement, conformity, power and security – are universal (shared by all cultures), although their particular expression is culture-specific (Schwartz, 1992).

Value dynamics refers to changes in the strength of commitment to particular values, to the way values are conceptualized and expressed in discourse and behavior, or to the way values interact to motivate action. Values change under the influence of time, institutions, social norms and life experiences (e.g. 'environmental epiphanies' (Vining and Merrick, 2012)). Individuals can perceive a variation in the *strength or intensity* of their value commitments, for instance when becoming more aware of the impact of the deterioration of environmental quality (water, air, soil pollution) on human and animal welfare. But they can also experience a *qualitative change* in values: for instance, what was initially an instrumental value (following social norms in order to be accepted or respected) is internalized in time and comes to be perceived as non-instrumental and non-anthropocentric values (Deci and Ryan, 2010).

Given that values influence behavior (Bardi and Schwartz, 2003), understanding value formation and value dynamics is essential for assessments aimed at informing policy decisions and governance. Not only do values change, but different types of values can be correlated positively or negatively, strongly or weakly, with pro-environmental behavior (Karp, 1996).

2.4.1. Context dependency, co-construction and co-evolution of values

Values are embedded in specific biophysical, socio-cultural and institutional contexts. People's values are shaped through tangible and intangible relationships with the natural and social environments, which in turn shape those environments (e.g. (Feld and Basso, 1996). Obvious examples are found in resource-based communities, such as farmers and fishermen, whose senses of place, community structures, and cultural traditions are intimately tied to the daily, tidal and seasonal practices of farming in a particular river valley, or fishing in a coastal region (e.g. Breslow (2014). Values are also deeply embedded in different knowledge systems and

worldviews, e.g. ways of conceptualizing people's relationship with nature and their moral responsibilities towards nature.

Socio-cultural environments also play a role in determining which values are activated in specific situations, and how values are expressed. Through personal experience, social learning and reflection, people's own understanding of these values - and of how they apply to concrete situations - changes. Depending on the shared beliefs, norms and practices that apply in a particular context, some personal values may take precedence over others. For instance, it has been shown that subjects who interact through market mechanisms tend to underestimate or disregard damage done to third parties as a result of their personal choices (Falk and Szech, 2013). More generally, framing choice situations in terms of monetary trade-offs "brings about a self-sufficient orientation in which people prefer to be free of dependency and dependents" (Vohs *et al.*, 2006). Subjects are thus more likely to emphasize self-regarding values (personal wellbeing, authority and power, freedom from external constraints) at the expense of other-regarding values (fairness, inclusiveness, reciprocity, trust). The expression of values also depends on the *methods* we use to identify and order values. Valuation methods do not simply identify preexisting values; they also act as *value articulating institutions* (Vatn, 2009). For instance, they influence the way particular environmental resources are described (e.g. a commodity or a common pool resource) or the relative importance of different value types (e.g. self-regarding or other-regarding).

In particular, markets have a significant impact on the articulation and expression of environmental values. Commodification and monetization, along with the broader economic and sociopolitical processes that support and promote them, can weaken such values and social capital that often sustain environmental action (Gómez-Baggethun and Ruiz-Pérez, 2011). In contrast, shared values and responsibilities are likely to be prevalent where people have joint dependence on, or shared access to, natural resources (Verschuuren *et al.*, 2014), and where governance is self-organized, participative and inclusive (Ostrom, 1990).

Environmental and cultural changes are also tightly interlinked. A growing literature on bio-cultural diversity highlights the interdependencies of biophysical and cultural factors, for instance between loss of habitats and loss of languages (Loh and Harmon, 2014). This literature shows that people are just as capable of protecting and enhancing biodiversity and its benefits (e.g.(Fairhead and Leach, 1996) as they are of eroding and undervaluing them.

2.4.2. Drivers of changes in values

Values are formed early in life, influenced by one's surrounding and family, and by exposure to and interactions with nature. They can be slow to change, even in the presence of new information. In fact, new information is often incorporated to justify an existing worldview (Hamilton, 2011). However, over time, values can change in response to the external environment, changing cultural norms and social learning. The drivers of value change include changes in individual circumstances, in the environment and community in which one lives, the assimilation of new information, changes in cultural norms, major political and economic trends (e.g. neoliberalism), historical conditions (e.g. colonialism), broad social trends (e.g. globalization and social movements), and acute events (e.g. war, natural disaster, political upheaval).

Individual values are revealed through individual action, but also through people's social behavior: bargaining, reciprocating, competing, collaborating, voting, governing etc. In particular, people's values are expressed through (and also influenced by) their participation in civic life and in marketplace exchange. The core idea of deliberative democracy is that instead of – or along with - marketplace exchange, or interest-group bargaining, citizens should continue to reflect together to learn from one another and develop new understandings that are more widely justifiable (Guttman and Thompson, 1996). Deliberation creates awareness of "our more remote and indirect connections with others, the long-range and larger-scale significance of what we want and are doing" (Pitkin, 1981). In this process, people take responsibility for justifying their own standards and values against those of the others, and against social norms and practices, thus remaining engaged in a joint effort of understanding and problem-solving.

2.5. Power and Equity in Value Articulation

Values and perspectives on values change, not only across scales, but among different people that value different aspects of nature, nature's benefits and a good quality of life in different ways. Therefore any attempt to assess values should consider equity, the distribution of power and who is included in it.

2.5.1. Equity

Equity, within the context of IPBES, can be broadly defined as the distribution and fair allocation of nature, nature's benefits, and the conditions that make for a good quality of life. At least two main dimensions of equity should be considered in the context of valuation: distributional equity (comprising inter- and intragenerational equity) and procedural equity.

Distributional equity concerns the allocation costs, benefits, risks and responsibilities as well as of the outcomes of nature. The loss of biodiversity and its benefits particularly impacts the world's poorest people who rely most directly on these benefits to survive and who often cannot substitute them with other products or services. Their rights to access and use certain resources, such as land, water or forests, are often not well secured. In such situations the loss of biodiversity can create tensions between different users, often to the detriment of those with less secured rights (Kosoy and Corbera, 2010). Biodiversity conservation must also be managed carefully to avoid creating further inequities (Krause and Loft, 2013).

A linear aggregation of values can obscure rather than clarify distributional issues. For instance, converting a forest into a plantation might produce higher overall economic benefits for people other than the original resource users. It may be that poor people no longer have access to the non-timber forest products on which they formerly depended and that the former range of cultural values may be lost. Thus, a disaggregation of values to highlight who benefits and who loses and to demonstrate the consequences for those affected is crucial for describing and understanding the shifts in values implied by different options.

Procedural equity refers to the inclusiveness in the decision-making processes and negotiation of competing values. Procedural equity deals with the issues of power asymmetries which affect who has a say regarding access and control of nature (concerning biodiversity use, conservation or destruction). Policy-making processes have sometimes inadequately addressed the interests and values of people who are actually or potentially affected, directly or indirectly. Participatory mechanisms that introduce dialogue and negotiation can be used to reveal different valuation and knowledge systems, reduce tensions and explore opportunities for compensations.

Distributional and procedural equity not only refers to the values of those currently present in a particular region. It is also vital that the needs and rights of future generations be acknowledged. As the IPCC puts it "*Intergenerational justice encompasses some of the moral duties owed by present to future people and the rights that future people hold against present people. A legitimate acknowledgment that future or past generations have rights relative to present generations is indicative of a broad understanding of justice. While justice considerations so understood are relevant, they cannot cover all our concerns regarding future and past people, including the continued existence of humankind and with a high level of wellbeing*" (page 12, Chapter 3: social, economic, and ethical concepts and methods. (IPCC. AR5 III (Mastrandrea *et al.*, 2011)). On a practical level different methods are more or less able to include concerns of future generations (see Chapter 3.1).

2.5.2. Power

Political, structural and social power asymmetries can affect the ways in which values and knowledge systems are represented in actual decision-making situations and in participatory platforms. The level of procedural equity depends on whose voice and values are included in the debate and which contextual knowledge influences decision-making systems. By paying more attention to the methods applied, the inclusion of several voices can be enhanced. So the choice of method or approach can reinforce or to some extent counterbalance power relations.

The framing of the valuation process influences which values are taken into account, which ones are omitted and which ones may not be compatible with the type of measurement applied. Different measurements allocate different levels of importance to different types of instrumental, or relational values. Furthermore, the same people can provide different values depending on the choice of concepts and methods to measure these. The values held within a culture and/or discipline influence what type of value measurement systems will be developed.
Representation of traditional knowledge systems and spiritual/cultural values is a particularly challenging task. Explicitly including cultural dimensions, traditional knowledge of local and indigenous communities, as well as gender differences helps to ensure that important dimensions for assessment of values are included to strengthen procedural equity.

Site-specific knowledge and indigenous and local knowledge (ILK) should carry increased weight as they are based on proven good practice. For example, it has been recommended for the case of the Māori (http://www.mfe.govt.nz/publications/rma/maori-values-supplement/) to have particular regard to including "*kaitiakitanga: the exercise of guardianship by the tāngata whenua of an area in accordance with tikanga Māori in relation to natural and physical resources*." That is including site-specific local knowledge, local language and local worldviews. Self-representation of indigenous and local groups is critical to the correct inclusion of their values.

2.5.3. Inclusion

In practice, many decisions are political, meaning that they are about what trade-offs are at stake and whose interests are taken into account. The choice of valuation method can lead to a shift of focus.
The framing of decisions and the tools used to support them can provide greater insight into the values of different people, but can sometimes also disguise the political nature of the decision.

The type of approach taken and the type of questions asked as well as the methods selected to provide this presumably technical knowledge influences and often implicitly decides on whose values are included – they frame what questions are asked, what methods used, what data collected, what interpretation given etc. Making values explicit and contextual can help bring value dimension back into decision making. This implies the need to find an appropriate role for technical knowledge to inform rather than replace value-related debates in decision making. Particularly for biodiversity-related issues, which are highly contextual, such information should be drawn from various knowledge systems and include practical, local and indigenous knowledge.

2.6. Sustainability, resilience and values

The manner in which nature, its benefits to people and a good quality of life are valued is directly linked to the way sustainability is defined. Emphasis can be placed on sustaining or improving quality of life; it can be placed on the maintenance of the flow of benefits from nature to society; it can be placed on the protection of biodiversity and the continued functioning of ecosystems. The integration of the diverse conceptualizations of values can contribute to an assessment of the incommensurable dimensions at stake.

Values associated with the resilience of nature are also relevant. Social-ecological resilience (to undesirable change) is needed to cope with endogenous and exogenous changes to biophysical and societal conditions. Values associated with this resilience are then linked not to the particular state of nature, the flow of benefits or the quality of life, but rather to their ability to cope with change in ways that are compatible over time.

2.7. Conclusions

Understanding how values are conceived, formed, expressed and represented is crucial for good decision-making. Across the world there exists diverse understandings and conceptualizations of the values of nature, nature's benefit to people and a good quality of life. These different worldviews, cultural beliefs and norms influence the predominant types of values and the ways in which they are articulated. Values are also informed by the context in which they develop including one's environment, socio-cultural norms,

institutions and notions of rights and responsibilities. They can change across spatial, temporal and social-organization scales. Neither are they absolute nor static. Value formation and articulation changes over time in response to local and global events and to changing individual or social circumstances, the external environment and new information.

The state of the natural environment, including threats to the continued supply of nature's benefits to society, can have a strong influence on behavior. For us to realize the value of biodiversity and our dependence on its benefits it is vital that we can account for and make visible the multiple and plural values that people hold. A range of approaches are needed to capture and represent these values and while some can be complementary, there is the prospect of disagreement too. It is essential that the environmental policy-making process understands and represents these values including those of people whose access to income or nature's benefits is the most restricted. It is important too that we take into account the rights and needs of future generations.

There are diverse and significant threats to the sustainability of nature and nature's benefits to people. If we are to inform values and guide them towards a sustainable future, then we will need to strengthen our understanding of value systems and align this to an improved knowledge of social-ecological dynamics.

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Chapter 3: Valuation methodologies

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This chapter outlines the key methodologies needed for an IPBES valuation or valuation assessment, and how different conceptualizations of values influence the choice of method. The chapter has three sections. Section 3.1 proposes a 6-step protocol for IPBES-related original valuations or literature-based assessments. A major step in this protocol is to scope the entire process. Section 3.2 introduces common types of valuation methods and Section 3.3 outlines ways to integrate or bridge diverse valuation approaches. These sections describe choices in methods and approaches, and guide IPBES researchers to relevant fields, subfields, journals, books, experts, and other information sources.

3.1. Proposed IPBES protocol for valuations and assessments

To ensure consistency among IPBES valuations, we propose a 6-step protocol to guide both original valuation studies and literature-based assessments, as illustrated in Figure 3.1. For a literature-based assessment, the focus will be on the choice of existing studies, and the type(s) of method(s) each employs.

Figure 3.1.: Illustration of the six steps according to the proposed IPBES protocol for valuation and assessment processes. Orange and green colours indicate that the scoping applies to methods for both valuation and integration/bridging.

3.1.1. Identify the Purpose. Clearly identifying the purpose of a valuation is key. Purposes include decision making at the public, community, and private levels (e.g. implementation of public policy instruments, project design at any level); raising awareness (e.g. to inform private decision making); accounting (e.g. at national or business levels); litigation for environmental liabilities and conflict resolution (Gomez-Baggethun and Barton, 2013). In particular, businesses interested in the environment beyond the obligation to abide to public management regulations may wish to conduct a valuation or assessment study for that purpose (see Appendix 1 on valuation approaches applied to business).

3.1.2. Scope the Process. The choice of valuation method is not a neutral decision. The results of a valuation are shaped by the method(s) and how diverse methods are synthesised. Even seemingly technical details can significantly affect outcomes. Appraisal methods themselves articulate values. They influence how the environmental resource or quality is characterized (e.g. a commodity or a common pool resource), which value dimensions are emphasized (e.g. individual values or social values) and how they are measured (e.g. via willingness-to-pay surveys or group deliberation). Valuation methods are seen as rules concerning a) who should participate and in which capacity, b) what is considered as data and which form data should take, and c) rules about how a conclusion is reached (Vatn 2009). It is therefore very important to address the following considerations *before* choosing valuation methods, information sources, and integrative approaches.

A. World views. There are many diverse world views. The IPBES conceptual framework considers two examples specifically (represented in green and blue fonts in Figure 1.1 in this guide). The scoping process needs to identify which world views are relevant to the valuation's purpose and, for the sake of transparency and validity, articulate which views are used. The choice of world view affects the choice of methods. Valuation methods and approaches differ in their ability to accommodate more than one worldview. Some methods reflect primarily one, while others are designed to accommodate several.

B. Focus of value. Values can be focused on nature, nature's benefits to people and/ or on a good quality of life, in line with the IPBES conceptual framework (cf. first column in Table 2.1, and section 2.2.2).

C. Types of values. The IPBES conceptual framework categorises values, at the broadest level, into anthropocentric (instrumental and relational) and non-anthropocentric values (cf. second column in Table 2.1). As discussed in sections 3.2 and 3.3 below, some valuation approaches are mainly applicable to anthropocentric values (e.g. ecosystem services valuation), while others mainly apply to non-anthropocentric values (e.g. measures of biological diversity and ecological integrity), and only a few methods are capable of assessing both. Methods also differ in how they account for a plurality of values, such as the diverse ways in which people value nature and its benefits to people, illustrated by the different definitions of "good quality of life" in the IPBES conceptual framework. Some methods can account for a wide range of values while others are better suited to exploring one or a few value types in depth. Valuation methods as well as methods of integrating, bridging or assessing diverse valuation approaches further differ in their basic assumptions about whether values are commensurable, and to what extent incommensurable or weakly comparable values can be expressed in common terms (cf. Chapter 2). Some methods attempt to aggregate all values into a single quantity (measured in terms of money or energy, for example), some strive for partial aggregation by means of consensus building or mathematical aggregation, and other methods do not aggregate at all, because of difficulties in expressing and comparing plural values in one comprehensive measure (Martínez-Alier 2009, Pascual et al. 2010).

D. Scale. As explained in Chapter 2, scale refers to the dimensions of space, time, and social organization. For example, spatial scales may include local, regional, and global; temporal scales may include human generational, evolutionary, and geological; and scales of social organization may include individual, household, and community. It is important to keep in mind that both human and natural scales matter with respect to space and time. Methods differ in their ability to integrate and cover changes in values across different spatial, temporal and social organizational scales –with respect to both the valuation and assessment process itself and the values that are expressed.

E. Social engagement and responsibility. All valuation methods are embedded in a social context; methods are explicit about this to a greater or lesser extent. Valuation methods differ in how actively they deal with participation. Some valuation methods do not require active participation of stakeholders, some methods involve people primarily as knowledge providers, and some methods seek to engage a wide range of social actors, often representing different knowledge systems, in the valuation process, including problem definition and selection of alternatives and evaluation criteria. Such a collaborative valuation process may require the empowerment of underrepresented groups and consideration of ethical issues. Involving various knowledge holders (such as citizens, local and indigenous people) in the process entails a moral responsibility on the part of the researcher to assure that these communities feel the benefits of their contribution to the valuation process and its results and real life applications. Further ethical considerations include whether collecting, reporting on, and assessing values can harm people in any way (e.g. by revealing private information, being too invasive with research, omitting or undercounting the values of marginalized people, or transgressing sovereignty and self-representation).

The effects of a valuation or assessment process on people can go well beyond the process, as it can influence decision-making and the resulting changes in nature and its benefits (cf. Step 6). Valuation thus has a distributional impact, in that some may win and others lose if decisions are made based on its results.

F. Broader social context. Relational values are important elements in the valuation of nature and its benefits. Thus, the scoping process must consider how methods take into account the nature of relationships between people across scales, including power relationships, the distribution of incomes and resources as well as gains and losses, externalities, and reciprocal relationships. These considerations include persons not actively taking part in the valuation, especially future generations. Consideration of the broader social context includes how methods account for the effects of anthropogenic assets, institutions, governance, and other drivers on the values of nature and its benefits.

G. Practical considerations include the availability and need for resources and the information costs (e.g. time, personnel, funding, equipment), knowledge, information and data (see Chapters 4 and 6). Different types of methods require different technical skills and tools, time and professional expertise.

3.1.3. Choose and apply valuation method(s). The choice of methods is a critical part of the valuation process, as it is an important determinant of the valuation outcome. The conscious choice of valuation methods includes reflecting on who is making the choice, explicitly setting out the assumptions embodied in the method (section 3.2), and considerations in the scoping (step 2, cf. figure 3.1).
The selected valuation method(s) are then applied following the rules used in the relevant scientific literature. An assessment of anthropocentric values must consider how they are related to the current state and potential changes in nature, nature's benefits to people, and good quality of life. This emphasizes that valuation of biodiversity and ecosystem services requires a consideration of the state and/or change in nature. For the intrinsic values of nature (non- anthropocentric values), the state and changes in nature's benefits to people and good quality of life are irrelevant.

3.1.4. Choose and apply method(s) for assessing, integrating and bridging different valuation approaches, if appropriate. Value assessments based on literature studies, but also original valuation studies that involve multiple methods, often require a further step of integrating different assessments of values (Gómez-Baggethun et al. 2014). Some integration approaches aim to aggregate valuation results into a unique outcome, while others do not. It may be difficult to integrate assessments following different worldviews (e.g. approaches of economic valuation and approaches that believe that Mother Earth is a living being). If integration is not possible or desirable, value types may still be bridged and aspects such as conflicts, synergies, and trade-offs between values examined. Approaches and methods of integration or bridging are reviewed in Section 3.3.

3.1.5. Interact with the public and decision makers. Valuation results can be communicated in various ways, including media releases, public hearings, expert workshops or publication in scientific journals, among many others. The representation of values can include quantitative, narrative, visual, performative, and other forms. It should clearly set out uncertainties in the results and the assumptions and limitations of the process as far as possible. A report on the valuation process should specify who was involved in identifying the purpose of the valuation (step 1), scoping it (step2), and in choosing and applying the methods (steps 3 and 4). It should give the reasons for choosing this particular group and explore what this implies for the legitimacy of the process. The feedback into society includes informing private and public decision makers, stakeholders, and practitioners, for example in direct consultation. Feedback to the public can also be indirect, as the persons taking part in the valuation process communicate with other persons in society. This way, the valuation process will affect decision making as well as the values themselves.

3.1.6. Review valuation or assessment process. It is important to review the process to analyse its strengths and weaknesses and improve it in the next process of valuation. The overall process may be considered iterative, starting again with the scoping step (step 2). A particular iterative process can involve adaptive decision-making, where decisions and their implementation are revised and adapted based on the obtained values and aim at further learning about or developing values. Alternatively, a changed purpose of valuation may arise and thus a new valuation process can start.

1.1. . Types of valuation methods

Depending on the purpose of valuation (step 1 of the valuation process), a full assessment of values regarding conservation and sustainable use of biodiversity, long-term human well-being and sustainable development may require a multi-method approach. Strategies of integration include interdisciplinary and transdisciplinary approaches (Baumgärtner et al. 2008), mixed methods, triangulation, and multicriteria analysis (section 3.2.6.). Most of the methods described in the following sections are inherently multidimensional, and draw from multiple data sources to provide integrated assessments of values and contextual explanations for how and why values develop and change.

Methods are presented in alphabetic order.

3.2.1. Biophysical and Ecological methods

The literature has used the notions of ecological values and ecological valuation with different meanings and in very different contexts, ranging from references to the intrinsic values of species, to conservation values, and values associated with ecosystem integrity, resilience, stability, and productivity. Despite this variation, the literature on ecological values generally aims to examine the *ecological importance* of attributes, qualities, and quantities characterizing nature's condition and functioning.

In ecology and conservation science, valuation has traditionally endorsed a biocentric perspective, covering various measures of the integrity of the biotic and abiotic components of ecosystems irrespective of their instrumental value for humans, including populations, communities, functional groups, functional traits, and habitat types. Thus, ecological values may be attached to particular sites, species (e.g. populations, characteristics), species composition, genetic composition, or to ecosystem processes, function, structure, and ecosystem characteristics such as complexity, diversity, rarity, and stability that contribute to the potential supply of ecosystem services (de Groot et al. 2002).

In the ecosystem services literature, ecological values relate to the ecosystem functions, processes and components on which delivery of ecosystem services and benefits to humans ultimately depends (de Groot et al., 2002; Luck et al., 2003; Elmqvist et al., 2003; Kremen, 2005; Harrington et al., 2010, Kontogianni et al., 2010; García-Llorente et al., 2011). They measure the ecological health and integrity of an ecosystem and its capacity to perform regulation and habitat functions as measured by ecosystem parameters, such as complexity, diversity, productivity and stability (de Groot et al., 2003; Gomez-Baggethun et al., 2014).

The notion of ecological values has been often used in relation to measures of ecosystem services in biophysical units, often using modelling platforms (InVEST, ARIES, MIMES, etc). Measures may include the amount of ecosystem services that can potentially be supplied (e.g. amount of biomass available for fodder, or area that is suitable for nature-based tourism), the amount of services that are actually delivered to users (e.g. total production of crops or water conditions in relation to standards for different water users at or above withdrawal point) (Tallis et al. 2012) and positive and negative interactions among ecosystem services (supply, delivery, demand), and bundles thereof (i.e. sets of services that appear together repeatedly through space of time) can be assessed (Rodriguez et al. 2006; Raudsepp-Hearne et al. 2010).

The *insurance value* (Armsworth and Roughgarden, 2003; Pascual et al., 2010; Gómez-Baggethun and Barton, 2013, Baumgärtner and Strunz 2014) relates to the importance we attribute to ecosystem resilience. It refers to the role of biodiversity and ecological infrastructure in securing ecosystem capacity to deliver sustained flows of ecosystem services in the face of disturbance and change. Securing such capacity involves maintaining critical amounts of ecological infrastructure for 'healthy' functioning, sometimes referred to as 'critical natural capital' (Deutsch et al., 2003). In everyday practice, the status of critical ecological infrastructure and related insurance value may be recognized by applying the precautionary principle and setting safe minimum standards or boundaries. The idea of insurance as connected to biodiversity and ecological structures stems from both empirical work and modeling exercises indicating that biodiversity compensates for fluctuations in individual species populations and the functions they perform within their systems (Ehrlich & Ehrlich 1981; Walker 1992; Loreau et al. 2001), in particular due to portfolio effects (Hoekstra 2012, Schindler et al. 2010). Ecosystem resilience to disturbance has been associated with higher levels of functional diversity and redundancy of species performing specific ecosystem functions (functional redundancy), which in turn increase response diversity (Elmqvist et al. 2003; Mori et al., 2013). Regime shift analysis and assessment of ecological thresholds are important tools to address level of threat on insurance values.

Ecologists often use the word value to mean a numerical amount denoted by a magnitude, quantity, or number and many ecological economists link the notion of ecological valuation with allegedly objective biophysical measurements of ecological impacts from human activity (Martínez-Alier, 1987, 1993; Naredo, 2001). Biophysical valuation methods have been used to calculate physical costs (e.g. in time, energy, materials, land surface, etc) and levels of pressure of human activity on ecosystems (Martínez Alier 1987; 2002; Gomez-Baggethun et al. 2014). Biophysical approaches assess value based on the intrinsic properties of objects by measuring underlying physical parameters (see Patterson, 1998 for a review). Examples of biophysical valuation include embodied energy analysis (Costanza 1980), emergy analysis (Odum 1996),

exergy analysis (Naredo, 2001), ecological footprint (Wackernagel and Rees, 1997), material flow analysis (Daniels and Moore, 2002), land-cover flows (EEA, 2006), Life Cycle Analysis (Daniels and Moore, 2002), Human Appropriation of Net Primary Production (Vitousek et al., 1986) and Multi-Scale Integrated Analysis of Societal and Ecosystem metabolism (MuSIASEM) (Giampietro et al., 2009) (reviewed in Gómez Baggethun and de Groot 2010; TEEB 2010).

3.2.2. Cultural and Social methods

Cultural and social valuation methods have diverse theoretical assumptions, disciplinary backgrounds and original fields of application (Kelemen et al. 2014). Here we group all methods that apply a hermeneutic approach to the process of valuation, i.e. they are based on interpreting and understanding various ways of communication. They assume that values of nature, its benefits and quality of life, which all can be considered as *the foci of cultural and social valuation*, are rooted in individuals and at the same time are shaped by the social and cultural context in which individuals are embedded (Turnley et al. 2008). Thus, cultural and social valuation methods aim to valuate nature, its benefits and quality of life in a contextualized way by discovering the psychological, historical, cultural, social and ecological contexts and conditions (*the broader social context*), as well as the *worldviews* and social perceptions that shape individually held or commonly shared values (Chan et al. 2012). They are able to accommodate more than one *worldview* in the process of valuation and some of them (e.g. ethnographic and narrative methods) can help make connections between conflicting world views (cf. scoping consideration A, B and F).

Cultural and social valuation methods are able to reveal a wide range of *value types* including intrinsic, instrumental, non-instrumental and relational values (Chan et al. 2012a, b), and also help understand how specific contexts give rise to certain value types (cf. scoping consideration C). A typical investigation in cultural and social valuation processes is at the local geographical *scale* and a time *scale* of human generations. Approaches are heterogeneous in terms of the *scale* of social organization (Castro et al. 2014). For instance, ethnographic studies usually refer to the community level, preference assessment focuses more on individuals, while narrative methods can apply to various scales of social organization (cf. scoping consideration D).

Cultural and social valuation methods are particularly encouraged to engage a transdisciplinary approach which bridges multiple disciplines and includes non-scientist participants as partners. Due to the intensive fieldwork inherent in many of these methods, special attention should be paid to assure that the communities involved receive benefits from participation and that any harm caused by the research to participants is avoided (cf. scoping consideration E on *social engagement*). A case specific 'code of research ethics' discussed with and accepted by the involved communities can avoid or mitigate these risks. Among the *practical considerations* of cultural and social valuation methods we should note that they require strong social scientific skills and the commitment of those doing the valuation to be open, reflexive and responsible for the communities involved. Methods differ in their resource intensity (information costs), some require long lasting field work (e.g. ethnographic methods), some require strong computational skills and technology (e.g. geographic methods) (cf. scoping consideration G).
In the following we give a quick overview of diverse cultural and social methods which can be used to value nature and its benefits and contributions to quality of life. This non-exhaustive list of methods is presented in alphabetical order.

Ethnography is a process of observing and working towards understanding the world from the perspective of the people under consideration (Emerson et al. 2011). Ethnography as a method is defined by long-term living within a community, participant observation, daily note-taking, and the writing of a descriptive monograph. It is especially suited to grasping the nature of subjective values and meanings expressed through daily language, behaviour (including silence and absence), material culture, the arts and performance, the built environment, and cultural landscapes, among other forms. It is also well-suited to grasping differences in worldviews and how these lead to contradictions in values and conflicts among diverse social groups (Breslow 2011, 2014, Medin et al. 2006). Ethnography uses participation in the daily lives of people while observing and recording language, behaviours and settings, a process termed participant observation. Ethnography includes informal and formal interviews and surveys. Central to

ethnography is the need to build rapport with one's research subjects; to extend trust toward them so that they will honestly share their experiences and perspectives with you (Emerson et al. 2011, Bernard 2000).

Ethnoecological methods focus on understanding how people conceptualize, value, and use their local natural environments. Subfields include ethnobiology, ethnobotany, ethnoentomology and ethnozoology, among others (Society of Ethnobiology 2014). The focus of ethnoecology is typically "traditional ecological knowledge" (TEK), in which knowledge is defined broadly to mean the interdependency of worldview, knowledge, values, practices, and institutions related to a particular social group's relationships with its local environments (Agrawal 1995, Basso 1996, Hunn 1999). Related subjects are "indigenous knowledge," "experiential knowledge," "place-based knowledge," and "metis," among others (Berkes 1999; Breslow 2011, Nazarea 1999, Scott 1998). Methods used in ethnoecological research include participant observation as well as interviewing, cultural consensus analysis, cultural domain analysis, and social network analysis; methods drawn from cognitive anthropology such as freelisting, paired comparisons, rankings, pile sorting, and triad tests. Methods from ecology such as biological collections, landscape valuation, plots, transects, and diversity indices; and other methods such as rapid rural appraisal, oral history, visual stimuli, participatory mapping, market surveys, and statistical analysis. Ethnoecological information is often private, political, sensitive, and vulnerable.

Geographic methods, in particular methods of cultural geography, are especially useful for the valuation of nature and its benefits in that they identify and map values that are place-based, spatial or spatializable. Methods such as participatory geographical information systems (PGIS) and human ecology mapping (McClain et al. 2013) engage local communities in the research process, and can capture locally variable, subjective, cultural and intangible values related to nature and its benefits. Methods such as surveys, interviews, focus groups, and participatory methods are used to elicit values. Mapping tools such as GIS, GPS, and remotely sensed imagery allow geographers to spatially overlay different types of information to better understand spatial relationships between values of nature and nature benefits and other socioeconomic, ecological, and biogeographic information. Results are useful in landscape and marine spatial planning, and in other valuation assessments, such as integrated modeling (cf. section 3.3.2). In addition, geographers study the politics and cultural values inherent in the social production of space, place, scale, and maps (Lefebvre 1991, Tsing 2000), including counter-mapping: the creation of alternative maps to deliberately challenge conventionally mapped notions and claims that threaten local values (Peluso 1995).

Historical methods reveal how and why values of nature and its benefits have formed and changed over time. In particular, the field of environmental history reveals dynamic interrelationships among cultural values, social circumstances, and ecological conditions (Cronon 1990, White 1990, Worster 1990). It also provides instructive insight into the history of environmental politics, philosophies and social movements, including those contributing to the IPBES effort itself (Grove 1995, Hays 1959, 1987). The methods of environmental history include those of history in general, such as archival work, oral history, and the analysis of existing economic and social data, in addition to the methods of environmental science that enable insight into historical ecosystems. Environmental history is extremely valuable in that it can provide rich explanatory context for the results of the valuations and assessments of nature and its benefits.

Narrative valuation refers to descriptive methods which capture the importance of nature and its benefits to people, expressed via stories, influence diagrams and other visual and verbal summaries. Narrative methods can be used in parallel with quantitative methods such as multi-criteria evaluation (MCE). For instance, it is possible to use constructed scales in order to measure non-tangible aspects such as cultural heritage, and narrative descriptions can be incorporated as part of the analysis (see Chan et al. 2012, cf. preference assessment). Narrative valuation methods can draw on ethnographic methods to elicit the value information in different socio-cultural contexts (see above).

Political ecology is an interdisciplinary field that draws primarily from the insights and methods of development studies, cultural geography, environmental anthropology, and environmental history, among others. It produces case studies that examine how environmental problems are linked to multi-scalar political, economic, cultural, historical, and power dynamics, with particular attention to the experience of local and marginalized resource users (Blaikie and Brookfield 1987, Braun 2002, Hecht 1985, Neumann 1992, Peet and Watts 1996, Sivaramakrishnan 1999). Political ecology examines social drivers of

environmental change, the causes of environmental conflict, the implications for resource- and place-based communities, and the roles played by conservation, environmental science, and diverse values of BES (Breslow 2011, 2014, Forsyth 2003, Peluso 1993).

Preference assessment is a direct consultative method for analyzing perceptions, knowledge and values associated with nature's benefits. It can be used either in individual settings to understand personal perceptions or in group settings to elicit collectively shared values (Castro et al. 2014). In individual settings (i.e. interviews or surveys) respondents are asked to rank (Castro et al. 2011) or rate (Martín-López et al. 2012) the benefits of nature according to their perceived importance. These exercises usually involve a qualitative phase which aims to understand the motivations behind individual choices, and are often supported by a visual aid or a context dependent example to ease the value elicitation phase. Individual values are aggregated by mathematical-statistical methods. If preference assessment is carried out in group setting, participants are invited to debate the collectively shared values of nature's benefits in small groups representing their community (Palomo et al. 2012). Qualitative and quantitative information on the vulnerability and trends of nature's benefits as well as on the driving forces can be used as expert input to the discussions. Results of group discussions reflect collective choices instead of individual ones (hence no aggregation needed).

3.2.3. Economic methods

Economic valuation is founded in the theoretical axioms and principles of welfare economics. A defining principle is that the economic value is based on individual preferences, reflecting their individual needs, perceptions and *worldviews* (cf. scoping consideration A), as well as on the scarcities imposed by nature. Standard economic approaches are not consistent with some of the worldviews included in the IPBES conceptual framework. For example, Living-Well balance and harmony with Mother Earth precludes economic valuation of Mother Earth, which is seen as a sacred and a living being that cannot be commodified, monetized, or even considered a subject of economic valuation. The *focus of value* (cf. scoping consideration B) is typically on nature's benefits to people or how nature contributes to a good quality of life.

Economic valuation is restricted to anthropocentric *types of values* (cf. scoping consideration C). Economic values include use values and non-use values such as spiritual and existence values. Use values can be further disentangled. Uncertainty and biodiversity's resiliency role give rise to insurance values (Armsworth and Roughgarden, 2003, Di Falco and Chavas 2009, Quaas and Baumgärtner 2008, Baumgärtner and Strunz 2014). Bequest values reflect concerns for intergenerational distribution and sustainability (Baumgärtner and Quaas 2010). Often, but not necessarily, economic values are expressed using monetary units of measurement.

Economic methods span a wide range of *scales* (cf. scoping consideration D) in space and social organization, both with respect to the valuation itself and the values that are expressed. Non-market-based valuation starts at the individual or household level. Market-based valuation in open economies goes up to the global scale, as prices are determined on world markets. With respect to temporal scales, economic valuation often focuses on the planning horizon of the individuals included in the valuation study. These planning horizons differ with the particular value considered, but most often they span a few years up to a few decades. Depending on data availability, market-based valuation techniques may additionally make use of historical information going back up to centuries in the past.
The degree of active participation of stakeholders differs widely across economic methods (cf. scoping consideration E, *social engagement*). Most economic methods derive aggregate, social values from individual preferences. This aggregation reflects the *broader social context* (cf. scoping consideration F) and deserves particular attention, as it determines the outcome of economic valuation to a large extent. In particular the aggregate outcome of monetary valuation depends on the distribution of incomes and wealth both within and across generations. More generally, aggregation reflects assumptions concerning distributive justice, which is a relational value, and there is no unique consistent way for such an aggregation (Arrow 1951, Roemer 1996). Aggregation faces issues of (in)commensurability of values that arises because of different individual interests and because of complexity that entails a plurality of legitimate perspectives and values.

Mainstream empirical economic valuation techniques are well-documented in Environmental Economics textbooks (e.g. Pearce 1993, Freeman 2003, Perman et al. 2003). They are appropriate for the valuation of small projects that are not expected to have a wider effect on the economic and institutional context, or for accounting purposes. Generally, these methods can be divided into two main categories.

Market-oriented valuation techniques rely on market prices that capture values at the point of exchange and are useful for quantifying factor incomes, damage costs and replacement costs. However, they are dependent on the current distribution of income. Prices can also be used in a production function approach to assess the value of ES that have an indirect value for producing goods and services that have market value. ES values should take into account the change of flows and (natural) capital stocks. Two main methods can be used: (i) the cost of damages that is based on the current and future losses of production of goods and services, (ii) the replacement cost that constitutes a reference for valuing the damages occurred (Daly-Hassen, 2013; Low, 2013).

Non-market-oriented valuation techniques can be applied to value ecosystem services that are not traded on markets. They can be classified into revealed preference or stated preference methods. Revealed preference methods are based on consumer behaviour and identify the ways in which a non-marketed good influences the actual market for some other good. Preferences and values are 'revealed' in surrogate markets. Hedonic pricing or travel cost methods rely on data about the actual choices made by individuals (or institutions) in related markets. Stated preference methods make use of surveys, in particular using contingent valuation or choice experiments, to ask people to state their preferences for hypothetical changes in the provision of environmental goods or services. This information is then used to estimate the values that people attach to the environmental goods and services in question. When it is not feasible to apply the afore-mentioned valuation methodologies to estimate the changes in the provisioning of the relevant ecosystem goods and services, it is possible to refer to the results of valuation studies at other locations, in other words transferring values from one site to another. This is known as 'value transfer' or 'benefit transfer.'

Participatory Economic Valuation techniques basically reflect people's/stakeholders perceptions about resources and are used when markets for resources are either thin, weak, distorted or completely absent.

Integrated modelling is the dominant approach in climate economics, and employed in particular in the integrated assessment models of climate and the economy (Llavador et al. 2011, Nordhaus 1993, Stern 2007), but to an increasing extent also for valuing natural capital (Fenichel and Abott 2014, Quaas et al. 2012). This approach relies on three fundamentals: (i) an objective function capturing how the use of economic and natural goods and services contributes to individual welfare, and how welfare should be aggregated across individuals, time and uncertainty; (ii) a model of the natural and economic dynamics; and (iii) the resource allocation mechanism (Arrow et al. 2003). Theoretically, this approach allows deriving shadow prices for all ecosystem goods and services included in the analysis, whether they are of direct or only of indirect benefit for humans. Double counting of values cannot occur, as the 'total economic value' is derived in this approach. In particular, dynamic models take the interests of future generations explicitly into account, and stochastic models are capable of deriving option and insurance values.

3.2.4. Public Health Assessment Methods

Public health assessment, in our definition, comprises methods valuing the effects of ecosystem services on human health. Different domains of health need to be considered in this regard: nutrition, infectious disease, non-communicable disease and mental health (Myers et al. 2013). Depending on what type of health domain one is interested in addressing, a suite of tools and methods from diverse disciplinary backgrounds should be utilized.

Many public health assessments incorporate epidemiological methods which focus on understanding the patterns and determinants of disease through observational or experimental designs. The following study designs are characteristic of epidemiological methods: ecologic, cross-sectional, case-control, cohort, and randomized-control trial (listed in order of increasing rigor; Rothman et al. 2008). Ecologic studies measure the exposure and outcome at the *group* level (Morgenstern 1995). Cross-sectional studies measure the

exposure and outcome at *one time* point at the *individual* level (Zocchetti et al. 1997; Rothman et al. 2008). Such studies yield measures of prevalence of disease. Case-control studies identify individuals with a given health or disease state (cases) and analyze select (risk) factors contributing to that state through comparison with "control" populations, as similar as possible to the cases except for the select factors of interest (Greenland 2004). Such studies yield measures of the odds of the disease/health state of interest given exposure or not to - or possession of - the select factors. Cohort studies identify individuals who are exposed or not exposed to select factors/interventions and follow them over time (MacNutt et al. 2003). Follow-up post-exposure can be done prospectively or retrospectively. Such studies measure the incidence of disease/health to better understand factors that drive illness or maintenance of health. A *randomized control trial* (RCT) is an *intervention* trial where the exposure is *randomly* assigned (Rothman et al. 2008). Under the strictest definitions, some believe that RCTs are the only way to determine true causal inference.

There are a multitude of branches within epidemiology that focus on different aspects of the health/disease spectrum. A couple are described below to illustrate their differences. For example, social epidemiology focuses on the social distribution and determinants of health and explores how social issues/structures in society influence the distribution of health and disease. Social epidemiology may be a particularly useful lens for those interested in the effects of gender, social organization, economics, politics etc. on health (Berkman & Kawachi 2000). Nutritional epidemiology is the study of the ways in which dietary intake and nutrition predispose individuals and populations to a given disease or health state (Willett 2013).

Environmental health - a discipline within health - provides a framework for understanding the relationship between the environment, including ecosystem services, and human health (Moeller & Moeller 2009). Risk assessments and dose-response relationships relating environmental change to human health outcomes are standard methods applied in the field of environmental health. However, ethnographic and other social science methods can both also produce measures of environmental health outcomes and add insights to help interpret quantitative results (Baum 1995).

Psychological measurement methods are critically important for understanding the effects of ecosystem services, and change in those services, on people's psychological or "mental" health (Cohen et al. 1996). With the burgeoning interest in biophilia (Wilson 1984), and nature deficit disorder (Louv 2008), psychological measurement methods will inevitably become increasingly important.

Each of these methods and topics are relevant to the "scoping" process detailed above. For awareness raising and decision-making, there are many public health assessment measures that could be used to highlight the human health importance of land-use decisions or types of environmental change. Furthermore, if dealing with litigation or conflict resolution, epidemiological methods are seen as capable of proving aspects of causal inference and thus would be robust in the decision-making process.

The specific health valuation methods are ideal for understanding how changes in nature affect nature's benefits to people quality of life. These public health metrics are at the core of human wellbeing and are generally considered to be a universal human right. Nearly all public health values are anthropocentric by nature. Although there have been efforts to translate public health research and practice into systems usable and understandable by indigenous people (i.e. Durie 2004), much of public health centers on a Western approach and world view. Participatory approaches and social engagement are nearly always integrated into public health methods because this field was designed to serve the public interest. And, broader social contexts and issues of scale are nearly always included, specifically relevant to methodological approaches developed by social epidemiologists.

The most useful tool for reporting on values and informing the decision-making process would be a Health Impact Assessment of a particular environmental policy or change. These tools are still in their infancy as compared to Environmental Impact Assessments but could provide a relevant structure to understanding how quality of life changes as a result of environmental decision-making.

3.2.5 Holistic, Indigenous, and Local Knowledge-Based methods

Holistic, indigenous, and local knowledge-based methods aim to capture holistic values about peoples and nature whilst internalizing principles and ethical values about Mother Earth and 'Living-well' of indigenous and local knowledge systems. Holistic, indigenous, and local knowledge methods can be applied with indigenous ancestral territories and local communities, and in broader governance scenarios (national and subnational) where rights of indigenous peoples and local communities and the principles or rights of Mother Earth are fully recognized in legal frameworks.

Indigenous and local knowledge approaches to valuation are more likely to characterize and evaluate ecosystem benefits as gifts of Mother Earth subject to cultural norms and beliefs and inter-generational responsibilities, particularly for communities living within their ancestral territories. These approaches assume there are unique characteristics of indigenous and local communities interactions with nature that require specific understanding attuned to their world views and realities. The non-separation between nature and culture that is often but not exclusively true for indigenous peoples makes valuation for indigenous peoples a unique process, in which economic, social, cultural, spiritual, historical, and ecological aspects are inter-dependent parts of holistic systems of life (Illescas, 2007, Medina, 2014). Valuation in this context is place based and may not be suitable to generalize to other people or places. Local and indigenous language terms can be used to design the relevant local and indigenous knowledge concepts that valuations should follow (such as reciprocity, cultural aspirations, positive benefit to communities, fostering enduring relationships) as well as to measure how spiritual and cultural connections are expressed at individual and collective levels. Indigenous valuation approaches can also enable greater capacity for informed longer term decision-making of indigenous communities in ecosystems. Examples of indigenous valuation models include the Cultural Health Index (CHI), Māori Wetland Indicators and the Mauri Assessment model from New Zealand, the "Indicators for Living Well" in Bolivia, the "Plans of Life" model from the Amazon region and the Coast Salish Indigenous Health Indicators from the US and Canada.

Holistic valuation of systems of life of Mother Earth aims to value the relationships and dynamics, either positive or negative, established among peoples and nature regarding the regeneration or reproduction of the systems of life of Mother Earth for Living-well. Holistic valuation follows a rights-based approach, taking into account that Living-well in balance and harmony with Mother Earth (relational and cosmocentric values) is based on the complementarity of the rights of Mother Earth (intrinsic values) and the rights of peoples to their holistic development and eradication of poverty (instrumental values) (Bolivia 2010, Bolivia 2012, Pacheco, 2014a). This method will be more accurately applied when rights of indigenous peoples and local communities and principles or rights of Mother Earth have been included as intrinsic part of the national legislation or public policy frameworks. In this regard, the holistic valuation of systems of life can be developed at different levels (national, subnational, and local) assessing to what extent there is in a given jurisdiction a positive relationship and interactions between the conservation of environmental functions, development of sustainable production systems, and peoples' access to basic needs and services for poverty eradication, inherently entwined as systems of life in Mother Earth. This approach is developed using participatory planning and intercultural dialogue techniques, among others, in the context of deliberative multi-actor processes that help to evaluate the extent to which there are systems of life settled in practice in a given jurisdictional territory. An example of a holistic-based valuation is the "Systems of Life of Mother Earth" approach being developed in Bolivia, which includes the identification and characterization of systems of life, the establishment of complementary agreements with Mother Earth, and actions for the harmonization of systems of life of Mother Earth (Pacheco, 2014a, b).

1.2. . Methods of integrating and bridging different types of value

1.2.1.Deliberation

Deliberative valuation is based on the assumption that valuation is a social process in which values are discovered, constructed and reflected in a dialogue with others. Therefore, deliberative valuation invites stakeholders and citizens (the general public) to form their preferences for ecosystem services together through an open dialogue, which allows consideration of ethical beliefs, moral commitments and social

norms beyond individual and collective utility. Deliberation is considered to be an integrating and bridging approach to valuation for two reasons:

1. A deliberative approach can be applied to various valuation methods ranging from monetary techniques through cultural and social methods to health based valuation (e.g. deliberative monetary valuation, preference assessment etc.). Deliberation as a process can enhance the application of single valuation methods by broadening the world views and the types of values included, and explicitly targeting social engagement and empowerment.

2. Various deliberative techniques have been explored and are used to make publicly accepted and legitimate decisions that influence human-nature relationships. These techniques such as citizens juries and consensus conferences (Smith 2003) create forums for open discussion and debate on different worldviews, values and interests to reach conclusions, which reflect the heterogeneity of standpoints.

Deliberative valuation can accommodate diverse ***worldviews*** and offers a possible solution to increase understanding between them (cf. scoping consideration A). Deliberative valuation is particularly suited for understanding the meanings that people attribute to nature and nature's benefits to people, such as holistic concepts of the land, and it can accommodate diverse forms of information such as narratives and story-telling. Therefore, deliberative valuation is found helpful both in indigenous (e.g. Chan et al. 2012, Kenter et al. 2011) as well as non-indigenous societies context (e.g. Randir and Shiver 2013, Kelemen et al. 2013).

In a deliberative process, choosing the ***focus of values*** can be subject of discussion. Therefore, values can also be investigated in a holistic way by focusing on the complex interrelations between man and nature (O'Hara 1996), instead of separating the values of nature, nature's benefits to people and good quality of life. The aim of deliberative valuation is to help people clarify and articulate the diversity of ***value types*** including both anthropocentric and non-anthropocenctric values (Wilson and Howarth 2002, Spash 2007) as well as values which are expressions of personal utility or motivated by moral and ethical considerations (Wegner and Pascual 2011). Deliberative valuation accepts that values are plural and often incommensurable. The result of valuation is either consensus if values converge during the discussions (Wilson and Howarth 2002) or the clear and equal representation of conflicting values reflecting their incommensurability (Goodman et al. 1999) (cf. scoping considerations B and C).

Deliberative approaches are usually applied to local level questions (e.g. Soma and Vatn 2010) but they can also be used to address policy level problems (e.g. Stagl 2006). From a temporal perspective, deliberative valuation can capture the interests of future generations in addition to the interests of the present generations. From the aspect of social organization, deliberation invites participants to express principled views of the public interest or purpose as citizens, or members of the society, not private preferences about their own consumption opportunities as consumers (Sagoff 1988) (cf. scoping consideration D on ***scales***).

In deliberative valuation, participants are actively engaged in framing the valuation processes, carrying it out and communicating the results to wider audiences (cf. scoping consideration E on ***social engagement***). A close interaction between the participants such as local community members and/or stakeholder representatives as well as scientists and local knowledge holders can lead to greater awareness of the consequences of human actions for the environment (Kenter et al. 2011). The ownership of the process can foster participants' commitment to the outcomes which reflect their own problem framings. Participation can also give an equal voice to weaker groups, which sometimes requires their empowerment as a preceding step. However, participatory and deliberative processes can also be used strategically to legitimate decisions (see e.g. Smith 2003). It should also be noted that deliberative processes, which are based on small-group interaction, cannot capture the views of a general audience and hence may need to be supplemented by survey or interview methods (see e.g. Hanley 2001). Deliberative valuation is highly recommendable when valuing nature and its benefits, because nature and many of its benefits (particularly regulating ecosystem services) are common goods the existence of which has consequences for other people, in other parts of the world, and across generations. These choices are fundamentally ethical and hence the right question is not what "I want" (individual rationality) but rather what is right to do (collective rationality) (Vatn 2009). Open discourse, generated by deliberative techniques, is able to expose

relational values and reflect upon the *broader social context* of valuation. This can only be achieved if the process is inclusive, transparent, and gives equal voice to participants, which may require their empowerment as a preceding step (cf. scoping consideration F).

Deliberation is time and resource intensive, because social actors have to be engaged and involved at each step of the process often in large number, and transparency has to be provided through continuous dialogue along the science-society-policy interface. It is essential to have professional expertise in organizing and facilitating group processes (cf. scoping consideration G on *practical considerations*). Failures of deliberation are often caused by lack of time, weak preparatory phase (e.g. lack of empowerment of the marginalized ones), weak commitment of policy/decision makers and problems of representation (insufficient, illegitimate or unequal representation) (Spash 2007, Vatn 2009).

1.2.2.Integrated modelling

Integrated modelling reflects a scientific *world view* (A). State-of-the-art integrated models are set up in multidisciplinary or interdisciplinary efforts (Baumgärtner et al. 2008, Pandit et al. 2014, Perino et al. 2014, Sen et al. 2014, Schlüter et al. 2012, Thébaud et al. 2014). Accordingly, the *focus of value* (B) differs across modelling approaches. Integrated modelling studies for valuing biodiversity and ecosystem services simulate changes in biophysical aspects of ecosystems, followed by the application of one or more of the valuation techniques described above (e.g., biophysical or economic). Integrated modelling as an overall approach thus can deal with different *types of value* (C). A challenge for integrated analyses of socioeconomic systems is keeping coherence in their multidimensional representation (Giampietro & Mayumi 2000).

A major advantage of integrated models is that they can cope with different *scales* (D). The ecosystem services oriented integrated modelling approaches range from non-spatial to spatially explicit and from static to dynamic incarnations. Models can take spatial heterogeneity in both biophysical (e.g. the relative position of forests in a watershed) and socioeconomic (the spatial distribution of groups of stakeholders) variables into account (Hein et al. 2006, Voss et al. 2014a,b).

The purpose is most often decision support, with different degrees of *social engagement* (E). Some models are built *for* stakeholders, while others are co-developed *with* stakeholders. Integrated models make use of historic data or looser forms of knowledge embodied in stakeholder representation. Values, valuation and changes thereof can be represented through simulation of scenarios. This makes integrated modelling capable of exploring the relevance of changes in the *broader social context* (F) in all dimensions explained in Section 3.1.

Examples of integrated models include InVEST (Natural Capital Project, www.naturalcapitalproject.org), Marxan (www.uq.edu.au/marxan/), ARIES (Artificial Intelligence for Ecosystem Services, http://www.ariesonline.org/), and MIMES (Multi-scale Integrated Modeling for Ecosystem Services, www.ebmtools.org). Large scale projects that have applied them include TEEB (2010) and UK NEA (Fish, 2011).

1.2.3. Multicriteria Analysis

Multicriteria analysis (MCA), sometimes called multi-criteria decision-analysis (MCDA), is a prominent approach to integrated assessment in priority setting and decision-making context.
MCA is a combination of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into decision-making. It allows comparison of ecological objectives with socio-cultural and economic ones in a structured framework, and enables decision-makers and stakeholders to express their preferences for the different evaluation criteria through a weight elicitation stage (weighing) (Belton and Stewart 2002, Proctor and Drechsler 2006). One of the key advantages of MCA methods in valuing biodiversity and ecosystem services is that it allows a use of a mixed set of both quantitative and qualitative information; the latter can be incorporated in the analysis by using constructed scales. MCA methods are also suited for illustrating the allocation of cost and benefits for different groups (distributional impacts). However, standard MCA methods are not particularly well-suited for addressing question of right and wrong—or duties and virtues because they assume that all criteria can be traded off

for some other criterion (see Wenstop 2005). Hence they are compatible with consequentialist (results-based) but not with deontological (duty-based) ethics. Social multi-criteria evaluation (SMCE, Munda 2008) aims to foster transparency, reflection and learning in decision-making processes, simultaneously integrating political, socio-economic, ecological, cultural and technological dimensions of a problem. Constituting both a framework for structuring decision problems, and as a set of methods for generating preferences among alternatives, SMCE has the potential to take into account conflicting, multi-dimensional, incommensurable and uncertain effects of decisions explicitly enabling it to focus more on the 'decision process' itself, and not on a final result (Munda 2008). So, with this analysis policy making could find a best result in terms of social and environmental distribution. As various dimensions are taken into account, the main goal is to find a balance between them, aiming at 'compromise solutions' which colloquially could be called 'the least bad' solutions, to emphasize that we are far away from naively aiming at the 'best' solutions as in cost-benefit analysis (Munda 1995).

In SMCEs, weights are understood as importance coefficients and not as trade-offs. Aggregation conventions used are non-compensatory mathematical algorithms, meaning that criteria with smaller weights can be also influential, which excludes the complete compensability concept. Additional features are social actor analysis and conflict analysis. NAIADE, the Novel Approach to Imprecise Assessment and Decision Environments, is a discrete SMCE method developed by Munda (1995) that combines the use of mixed information types and conflict analysis. NAIADE produces a ranking of alternatives according to the set of evaluation criteria, and indications of the distance of the positions of the various interest groups and a ranking of the alternatives according to actors' impacts or preferences (Munda, 2008). Descriptions of the application of SMCE frameworks to different sustainability problems are described in De Marchi et al. (2000), Klauer et al. (2006), Munda (2008), and Antunes et al. (2011).

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Chapter: 4 Data and knowledge needs, sources and gaps

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Given the broad range, complexity and plurality of the values pertaining to biodiversity and ecosystem services (BES) described in Chapter 2, and the equally wide range of valuation methodologies outlined in Chapter 3, data and knowledge needs also vary considerably. As laid out in the valuation protocol (see section 3.1), the different spatial, temporal and social organization scales in a given value analysis may require different data and knowledge needs. In addition, valuation-related data and knowledge gaps are evident even for widely recognised systems and methodologies, such as the non-use values of boreal ecosystems. This chapter highlights the main types of data and knowledge needs that may be encountered while undertaking a valuation study, the major available data and knowledge sources on global, regional and local scales, and the main data and knowledge gaps.

This Chapter uses the definitions and typology of data, information and knowledge developed by the IPBES Data and Knowledge Working Group (IPBES/3/4[3]). It should be stressed that the scope of the data and knowledge analysis (needs, sources and gaps) is confined to valuation approaches that have been laid out in Chapter 3 and in particular to the three elements of the IPBES conceptual framework referring to valuation, namely, Nature, Nature's benefits to people and Good quality of life.

4.1. Data and knowledge needs

Depending on the scoping results emerging from the valuation protocol, appropriate choices of the method(s) will need to be made (see Chapter 3). The application of valuation method(s) requires multiple data sources, knowledge and information systems. For example, the adoption of landscape unit and classification systems for the valuation of ecosystem services will be necessary: the abundance of ecosystem services is directly linked to an ecosystem's extent (Costanza et al., 1997; MEA, 2005). But the span of services provided by an ecosystem and the level of its resilience depend on its inherent quality (Kremen, 2005; Pisupati, 2007) and on the values and behaviours of the people benefitting from, or "co-producing" those services.

Indigenous peoples' and local communities' knowledge and continued survival are essential to conserving, maintaining and enhancing biodiversity and ecosystem services in many parts of the world (IPBES International Expert Workshop 2014). Therefore, it is important to include a wide range of local case studies (particularly those based on ILK systems) into valuation approaches. In order to reflect the holistic and multiple values pertaining to BES in different valuation studies and assessments, consultative dialogue and discussions are an important cornerstone of the IPBES deliberative process.

Chapter 2 addressed how the value of nature and its benefits and what a good life encompasses change across time, space and social organization scales 2. So, for example, data and knowledge needs at regional levels will differ from those at national levels. Generally, data needs are greater for local scale analyses than for regional or global analyses). Possible formats for assessing the data needs at different scale combinations are given below in Table 4.1.

Table 4.1: Possible format for assessing data needs at different scale combinations

	Local, short term, appropriate level of social organization	**National, medium term, appropriate level of social organization**	**Global, long term, appropriate level of social organization**
Supply of	Need = high resolution data	Need = mixed resolution	Need = low resolution

[3] The generic types of data, information or knowledge defined by the Task Force are: Data (raw information from monitoring, research and observations), Information (analysed data), Knowledge and Knowledge Products, Indicators and metrics, Links and references.

Ecosystem Services	and ability to interlink data for short term decision support. Available = Mixed data and multiple tools; sufficient for scoping purposes in developed countries but insufficient for management. Insufficient for scoping or management in developing countries.	data and ability to interlink data for short and long term decision support. Available = Multiple data bases often organized per country and multiple tools.	data and high ability to interlink and disseminate data for long term decision support. Available = Sufficient data for scoping, insufficient ability to interlink.
Demand for Ecosystem Services	Need= high ability to recognise market and non-market sectors in managing tradeoffs. Available = ?	Need= ability to recognise market and support non-market sectors in managing tradeoffs in short and long term. Available = market based information and some socio-cultural information depending on country.	Need= ability to support all sectors with understanding of global ecosystem services and humanity's long term, collective needs. Available = market based information and some socio-cultural information.
Gap	Thousands of examples for specific ecosystem services.	Examples of ecosystem services supply; demand side lagging. Interconnections among ecosystem services and between local and global scale elusive.	Shortage for some global ecosystem services. Interlinkages among global ecosystem services elusive.

4.2. Data and knowledge sources

Existing data, knowledge and information sources on IPBES-relevant topics include: national, regional and global thematic datasets (i.e.: socio-economic, ecological, cultural); sectoral specific datasets (i.e.: forestry, agriculture, aquaculture, health etc); and products/processes/practices supported by both scientific assessments and Indigenous Peoples and Local Knowledge Systems. A table is presented for each relevant focus of valuation (nature, nature's benefits to people and good quality of life) pointing to possible sources of data, information and knowledge (these should be seen as illustrative as opposed to exhaustive lists).

Data and knowledge sources for the "Nature" component of the conceptual framework are diverse. In support of the Convention on Biological Diversity (CBD), data sources are available on the global, regional and sub-regional levels and national levels for biodiversity and ecosystems. There are a number of global biodiversity databanks for genetic diversity, species diversity and ecosystem diversity. As for data sources at the national level, most datasets may be available in local languages. Collection and integration of such data sources are critical to regional and sub-regional database development. The availability of regional data sources are not balanced among different continents; more datasets are available in Europe and North America.

Table 4.2.1: Examples of available sources of data and knowledge regarding the "Nature" component of the IPBES Conceptual Framework

Subject	Global	Regional	National/Local
Biophysical & ecological	IUCN[4], FAO STAT[5], CITES[6], Ramsar, WCMC[7], GBIF[8], CoL[9], OBIS[10], Tree of Life, WOA[11], GEOSS[12], GEO BON[13], GCP[14], USGS[15], DataONE[16], EOL[17], WCPA[18], WDPA[19], NWW[20], WWF Ecoregions, GenBank, NCBI[21], UNCDD[22], BIP[23]	ACB[24], ABCDNet[25], EIONET[26], BISE[27], EMODnet[28]	Gapminder, NOAA[29], NEON[30], NSII[31], CONABIO[32], Noah's Ark[33], National Agencies (e.g. forest, park authorities)
Socio-cultural, Holistic & indigenous	UND, MDG, GBO, CBD, MEA, WB, UNESCO		National environmental policies, statements of protection goals, anthropological and historical studies, cultural sources (music, poetry, literature...), social norms and laws

[4] International Union for the Conservation of Nature – Red List of Threatened Species and Ecosystems
[5] Food and Agricultural Organization Statistics
[6] Convention on International Trade in Endangered Species of Wild Fauna and Flora
[7] World Conservation and Monitoring Center
[8] Global Biodiversity Information Facility
[9] Catalogue of Life
[10] Ocean Biodiversity Information System
[11] World Ocean Assessment
[12] Global Earth Observation System of Systems
[13] Group on Earth Observations - Biodiversity Observation Network
[14] Global Carbon Project
[15] United States Geological Service
[16] Data Observation Network for Earth
[17] Encyclopedia of Life
[18] World Commission on Protected Areas
[19] World Database of Protected Areas
[20] Nature World Wide
[21] National Center for Biotechnology Information
[22] United Nations Convention to Combat Desertification
[23] Biodiversity Indicators Partnership
[24] ASEAN Center for Biodiversity
[25] Asia Biodiversity Conservation and Database Network
[26] European Environment Information and Observation Network
[27] Biodiversity Information System for Europe
[28] The European Marine Observation and Data Network
[29] National Oceanic and Atmospheric Administration (USA)
[30] National Ecological Observation Network (USA)
[31] National Specimen Information Infrastructure (China)
[32] National Commission for the Knowledge and Use of Biodiversity (Mexico)
[33] Noah's Ark National Biodiversity Database (Turkey)

In the "Nature's benefits to people" element of the conceptual framework, it is worth considering existing data sources in terms of the ecosystem service categories outlined in the framework. For provisioning services, multiple national and finer scale measures and data in relation to agriculture, fisheries, forestry, water supply and demand are available. For regulating services, there are fewer clearly linked data sets available. Nevertheless, estimated data of costs associated with damage relating to extreme natural events (like flooding, and sea storm coastal impacts), and restoration activities can be drawn from various sources. For cultural services, sacred site and cultural values mapping, access use rights, culturally important species' lists are available for some places; tourism data sets at different scales are available.

Table 4.2.2: Examples of available sources of data and knowledge regarding the "Nature's Benefits to People" component of the IPBES Conceptual Framework

Subject	Global	Regional	National/Local
Economic	MEA[34], TEEB[35] reports, WOA[36], FAO STAT, WB, WDCGC[37], IPCC, GDW[38], UN-SEEA[39]	European System of National and Regional Accounts, ADB[40], EU, EBRD[41]	NEAD[42] EVRI[43], Governmental Databases (eg. Fisheries, Agriculture, Forestry, Tourism Ministries, disaster monitoring centers)
Cultural and social	UNESCO-World Heritage, WEP-GRIN[44]		Academic literature (eg. Anthropological, geographic studies), art (paintings, sculptures etc), cultural sources (music, poetry, literature...), heritage sites and their justification
Public health	WHO[45], GBDD[46], DHS[47], FAO, MICS[48]	WHO, GBDD, DHS, FAO	DHS, Ministries of Health, CINE[49], MICS

[34] Millennium Ecosystem Assessment

[35] The Economics of Ecosystem Services and Biodiversity

[36] World Ocean Association

[37] World Data Centre for Greenhouse Gases

[38] Global Disaster Watch

[39] United Nations - System of Environmental-Economic Accounting

[40] Asian Development Bank

[41] European Bank on Reconstruction and Development

[42] National Environmental Accounting Database, University of Florida

[43] Environmental Valuation Reference Inventory

[44] World Economic Plants – Germplasm Resource Information Network

[45] World Health Organization

[46] Global Burden of Disease Database

[47] Demographic Health Survey

[48] Multiple Indicator Cluster Surveys (UNICEF)

[49] Centre for Indigenous People's Nutrition and Environment

Subject	Global	Regional	National/Local
Biophysical & ecological	TEEB, MEA, IUCN, FAO, CITES, WCMC[50], GBIF[51], WOA, GEOSS[52], GCP[53], USGS[54], DataONE[55], NWW[56], RAM Legacy, Sea around Us Project	SGA[57], ACB, APBON, ABCDNet, EIONET, BISE, EMODNET, EU	NEON[58], NSII[59], CONABIO[60], National Agencies (e.g. forest, park authorities)
Holistic & indigenous	UNESCO		Sacred site mapping, cultural values mapping, lists of culturally important species, CINE

There is an expanding literature accounting for different types of indicators of the "Good Quality of Life" element of the conceptual framework, coming from a range of backgrounds including country socio-economic performance and happiness indicators among other indicators of the different components of well-being, as well as poverty and poverty reduction literature.

Table 4.2.3: Examples of available sources of data and knowledge regarding the "Good Quality of Life" component of the IPBES Conceptual Framework

Subject	Global	Regional	National/Local
Economic	WDI[61], UNSD, MDG tables[62]		National census data
Public health	WHO, GBDD, DHS	WHO, GBDD, DHS	DHS, Ministries of Health
Biophysical & ecological	MEA, IPCC reports		UK-NEA
Socio-cultural, holistic & indigenous	MDG reports, World Database of Happiness	Knowledge products	UK-NEA

[50] World Conservation and Monitoring Center
[51] Global Biodiversity Information Facility
[52] Group on Earth Observations
[53] Global Carbon Project
[54] United States Geological Service
[55] Data Observation Network for Earth
[56] Nature World Wide
[57] Sub Global Assessments (MEA)
[58] National Ecological Observation Network (USA)
[59] National Specimen Information Infrastructure (China)
[60] National Commission for the Knowledge and Use of Biodiversity (Mexico)
[61] World Development Indicators
[62] Millenium Development Goals Tables

4.3. Data and knowledge gaps

- Regional & local datasets (not as visible as global datasets)
- Regulating services are usually modelled, actual data sets are lacking and the Regulating ES are usually specific to each locality
- More comprehensive awareness and understanding of cultural and social values are needed
- Public health value understanding is lacking
- Availability of spatial data at finer resolution for valuation is lacking
- Even where data exist at local levels, consistent updates of all data types (economic, biophysical, social etc.) are lacking
- Knowledge gap - techniques of linking bio-physical and socio-economic components
- Traditional, Indigenous and Local Knowledge sources (including the need to improve their registration and inventory development)
- Not only further ethnographical and historical knowledge sources are needed but also there's a need to increase awareness on their importance

The above-mentioned gaps should be seen as clear messages to respective IPBES member states about prioritization and funding challenges to address them. In addition to these data and knowledge gaps, it is important to highlight the challenges involved integrating different types of data within a valuation study, not just due to incommensurability but more often due to disciplinary and worldview rigidities. Using information captured in traditional knowledge systems such as songs, rituals, and dances, for environmental management and decision making might be helpful, but remains underexplored.

4.4. Data and Knowledge Accessibility

How easy it is to access data for the purposes of conducting valuation studies or assessments can vary substantially for a given task. Some data are public while others have property rights or are licensed. For example, most Elsevier publications are only available through paid subscription. Open source journals such as Public Library of Science (PLoS) and Global Biodiversity Information Facility (GBIF) are accessible with internet use. Even if publically available, there may be limitations to access, infrastructural and human capacity to access data (online and other forms). At national levels, there are issues concerning governmental databases related to uncertainties and biases as well as restricted access.

Different data sources contain results from different types of valuation methods. Peer reviewed journals are a good source for biophysical and economic valuation methods and can be easily accessed through online searches of publication outlets (e.g. Springer, Elsevier etc.). Books are especially important sources of academic information for socio-cultural and holistic methods; however, they may not be widely available or translated. Grey literature can contribute information on any of the valuation methods but locating each type of grey document can be time consuming as they can vary widely across countries and types of valuation methods. Global and national databases (e.g. FAO, NOAA, WB, NEON) can provide information for a range of valuation methods. Because data and knowledge related to socio-cultural aspects are mostly collective, oral and un-written, different sources must be considered (e.g. narratives, images, folk art forms and other oral and visual traditions).

Awareness and sensitivity are needed when approaching ILK systems for capturing knowledge and information. In accordance with the recommendations of IPBES ILK working group, synergizing ILK and science in the context of a given IPBES task requires the development of robust relationships and trust across the diverse group of knowledge holders and following appropriate protocols for mutual exchange, compilation and analysis of information to ensure reciprocity, transparency, shared benefits and understanding of potential risks (IPBES 2014). IPBES should follow best practices and ethical standards for the use of published material and ensure free prior informed consent (FPIC) for access to undisclosed knowledge (ibid). In the context of many assessments, aggregated information and information on importance are sufficient rather than on exact location or other sensitive information; this can help to ensure the privacy of ILK, and inclusion of ILK even under tight timelines.

4.5. Collaboration means

Documenting the wide range of BES values requires a sustained effort to collaborate with a network of partners and stakeholders. Consistent with the objectives of Knowledge and Data Strategy and Knowledge and Data Management Plan, close collaboration is required with the custodians of data and knowledge pertaining to BES values and valuation.

It is foreseen that successful data accessing can be attained both within and outside IPBES:

→ Collaboration within IPBES
- ILKS Task Force
- Knowledge & Data Task Force
- Member states

→ Collaboration outside IPBES
- IPCC
- Regional networks & regional professional organizations
- NGOs (IUCN, WWF, WCS, etc)
- Other international initiatives on data banking and management (WCMC,UNEP etc)
- Academic institutions to build on research base
- Observation networks (ie. GEO-BON, İLTER, citizen science groups)
- ILK social organizations and ILK communities

Furthermore there is a need for collaboration with local partners in a range of countries to guide access to grey literature and relevant data sources that are not openly accessible. Guidance is often needed to access open databases that are not easily found, to identify which types of grey literature or documents would be most useful and where to find them.

APPENDIX
An example of data and knowledge sources pertaining to **'Nature's benefit to people'** component of IPBES conceptual framework

Examples of valuation methods	**Examples of data sources**	**Examples of knowledge sources**
Economic	World Bank (World Development Indicators) http://data.worldbank.org/topic EVRI https://www.evri.ca/Global/HomeAnonymous.aspx	Scopus Web of Science Wiley Online Library EconLit
Ecological/biophysical	FAO http://faostat3.fao.org/faostat-gateway/go/to/home/E IUCN http://www.iucnredlist.org/	Scopus Web of Science Wiley Online Library SpringerLINK BIOSIS
Social	UN http://unstats.un.org/unsd/default.htm UN DESA http://undesadspd.org/	Scopus Web of Science ScoINDEX Academic Search Premier
Cultural	UNESCO http://portal.unesco.org/culture/en	Scopus Web of Science

	/ev.php-URL_ID=35166&URL_DO=DO_TOPIC&URL_SECTION=201.html	Wiley Online Library EBSCO eHRAF world cultures
Health–related	UNICEF http://www.unicef.org/statistics/index_countrystats.html WHO http://apps.who.int/gho/data/?theme=main	PubMed CAB Abstracts & Global Health MEDLINE ScienceDirect
Holistic and ILK	UNESCO http://www.uis.unesco.org/Pages/default.aspx	eHRAF world cultures Ethnographic video online

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Chapter 5: Integrating diverse conceptualization of holistic and multiple values of biodiversity and ecosystem services into IPBES activities. Tools that would be used to inform the development of assessment under deliverables 2b, 2c, 3bi, 3bii and 3biii

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This chapter guides experts on how to practically apply the concepts outlined in chapter 2 and the valuation approach developed in chapter 3 in IPBES assessments. It also provides initial thoughts for the assessments currently planned in the first work plan.

5.1. How to apply this guideline in the context of assessments?

The valuation process protocol developed in Chapter 3.1 can also be applied to IPBES or other regional or thematic assessments. Table 5.1 (see below), an expanded version of Table 2.1, sets out some of the steps in the protocol: first specify 'key 'things' of value' and then, for each 'thing of value', add 'key stakeholders & knowledge sources', 'methods/approaches' and 'sources of data and information'.

'Methods/approaches' in an assessment context refers to the methods/approaches chosen by the studies available and will help to characterise the information available. The table has been tentatively filled for each of the upcoming assessment topics. Section 5.2 illustrates the stepwise approach with the example of a thematic assessment on land degradation, 5.3 for pollination, 5.4 for invasive species, 5.5 for sustainable use, and 5.6 provides some ideas for regional assessments. These subsections are presented to illustrate procedure and provide initial ideas. We hope this can serve as an input for the teams mandated with conducting the assessment. The content of this section is the result of a quick brainstorming by the authors of this guideline, who are experts on valuation, but not necessarily on the different subject matters covered. Thus the content is meant to trigger discussion and does not provide exhaustive answers for each of the assessments presented here.

Assessment teams usually work under very tight time schedules and mainly rely on existing studies and knowledge to compile the assessments and derive overall conclusions. Under these conditions it becomes particularly challenging to adequately represent different worldviews and conceptualizations of values and there is no silver bullet to doing so.

A first important achievement for any assessment is to identify which values might be at stake and thus relevant for a given topic of assessment. For this, it is also important to consider the different paradigms, worldviews and knowledge systems about a "Good Quality of Life" according the IPBES Conceptual Framework (e.g. well-being and living-well) and what types of values are at stake. In addition, this implies considering all 'key targets of valuation' for each worldview regarding Good Quality of Life and 'type of value' and then specifying and selecting which are applicable. For most cases, not all of them will be applicable so some rows might remain empty or be considered of minor relevance and thus not further pursued. Once the relevant 'key things of value' are specified according to the purpose of the assessment, Table 5.1 can help to narrow down where to find studies, and which methods and approaches might be adequate. Even in cases where no additional studies are possible, providing such an overview is already a useful output. In addition, available study results can be characterized in terms of values covered, at what scales (time, space and level of social organization) and this information should be explicitly included in the assessment. Following such an approach will (a) help to broaden the search for relevant information on values, and (b) help to structure the presentation of available information, even if complete coverage will rarely be possible, and (c) allow the assessment team to identify what sorts of values have been predominantly studied and to identify where current gaps lie. This already is a type of assessment of values and provides helpful and important additional information to any IPBES assessment.

Table 5.1						
Focus of values	**Types of values**	**Key targets of valuation**	**Examples of key 'things' of value**	**Key stakeholders, knowledge sources, expertise**	**Methods/ approaches.**	**Data & Information sources**
NATURE *Intrinsic value*	**Non-anthropo-centric**	Individual organisms	*to be specified according to assessment topic*	*to be added for each 'thing' of value identified*	*to be added…*	*to be added…*
		Biophysical assemblages	*to be specified according to assessment topic*	*to be added*	…	
		Biophysical processes	*to be specified according to assessment topic*	…		
		Biodiversity	…			

How to use Table 5.1:

When scoping what values are at stake we recommend first considering all types of values listed. Not all of these will necessarily need to be included or will be applicable/relevant for your assessments. The values are related to a specific paradigm and worldview, but for most IPBES assessments more than one worldview will be relevant.
Note: the table is not a balance sheet breaking down values into distinct categories that could be added up to some sort of a 'total value'. There is overlap between the different categories and their significance will vary according to context, world view and purpose of valuation.

Double counting of values is an issue only in certain applications such as calculating economic values for national accounting or aggregating 'total economic value'. Different time scales need different types of valuation. Similarly assumptions e.g. discount rates (often differing for private and social costs) also need to be carefully chosen according to the purpose. Also, it is important to note that same paradigms and worldviews do not include calculating economic values and accounting of nature and its environmental functions.

5.2. Land degradation and restoration

Short description of issues involved:

Degradation can encompass issues related to changes in forest cover, or land use, but also soil characteristics (physical, chemical and biological)and species composition and diversity, change in water dynamics (flow, infiltration, evapotranspiration, filtration and purification). Restoration can be attempted for a variety of reasons. Restoration may be focused on restoring composition, ecosystem functioning or particular ecosystem services, it can include major changes such as rewetting a dried peatland, or comparatively minor changes in certain management practices. Multiple stakeholders are affected by land degradation in diverse ways. For certain cultures, this impact can be existential and similarly stakeholders have very different visions of what to restore and why depending on their world views, dependence on the services to be restored, and the contributions of these services to their quality of life. Incommensurable trade-offs occur among the actors that operate at very different spatial scales and that do or do not promote restoration for a variety of reason.

5.2.1 Illustrating the stepwise approach for land degradation

Here we apply the valuation process outlined in figure 3.1 to the assessment of land degradation, and assume it is to be conducted separately in different regional assessments as the global level seems too aggregated for collecting and assessing information. In the following we used the example of Africa.

Step 1 Identify the purpose of the land degradation assessment
Purpose of the IPBES assessment on land degradation: assess the extent, causes and processes of land degradation and the consequences for biodiversity and people, as well as evaluating responses to the restoration and rehabilitation of degraded land and the avoidance of future degradation.

Purpose of assessing values in this context: generate understanding of values affected/at stake, create awareness for costs of loss, inform the development of policy options, understand distributional impact of land degradation and implications for good quality of life.

Step 2 Scope the process for land degradation (for an assumed regional assessment in Africa)
3.1.2. Clarify the following *before* assessing values at stake, searching for information sources, and agreeing on approaches to aggregating, integrating or bridging different values and formats of results encountered:

H. World views. *Agreement on world views according to the IPBES Conceptual Framework to be considered should be achieved by assessment team*[63]. The worldview helps framing the assessment of values accordingly to a particular knowledge system. If necessary, all relevant world views represented in Africa for an African assessment of land degradation.

I. Focus of value. *Values can be focused on nature, nature's benefits to people and a good quality of life, (IPBES conceptual framework)*. Land degradation affects all of these foci, a regional assessment for Africa concerns all foci. See Table 5.1a

J. Types of values. All potentially relevant values should be identified, aggregation across all will not be possible, in depth assessment or partial aggregation and bridging might be relevant for some types of values. See Table 5.1b. What might make sense to aggregate, integrate or bridge will depend on the specific focus of the assessment and on the availability of relevant study results, as opportunities for additional valuation studies will be extremely limited if at all.

K. Scale. *There are at least two ways scale can be considered in the valuation process: the overall scope of the valuation or assessment*: Regional, e.g. Africa *and the scale at which values are expressed:* the latter needs to be made explicit for all study results that will be used in the assessment. *Spatial scale*: Africa, subdivision for different biomes might make sense; *temporal scales:* will probably be specified by the IPBES plenary e.g. last 50 years, the mandate might include some sort of scenario work for the future as well. *Social organization*: it is important to distinguish how values in available studies have been elicited, which may include individual, household, and community approaches. Scales of social organization are not to be confused with political scales. *In addition the scale of the audiences of the assessment, what policy or decision makers the assessment is supposed to inform, should be explicitly discussed (see step 5 below on reporting results).* The IPBES assessment on land degradation is probably addressing the global level (CBD, Convention on Desertification, …), as well as national governments in affected countries and donors providing development aid. Yet a continental, and especially a global, assessment would have to differentiate between different subregions, as it makes very little sense just to try and aggregate globally. *It is important to keep in mind that both human and natural scales matter with respect to space and time.* For land degradation this has implications. For example, restoring land after desertification requires long time scales and may also significantly affect adjoining landscapes, so values of preventing degradation, or losses due to degradation should not be calculated on very short time or spatial scales. *Before using a study in an assessment, it is important to understand what that study referred to and if it dealt with scales adequately.*

L. Social engagement and responsibility. *All valuation methods are embedded in a social and cultural context; methods are explicit about this to a greater or lesser extent. Key issues are who plays what role at each stage of the valuation and assessment process and who decides about the issues of participation. Some approaches seek to engage a wide range of social actors, who often represent different knowledge systems, in the valuation process, including in the stages of defining the problem, and choosing alternatives and evaluation criteria. This may require that underrepresented groups are empowered and ethical issues considered. Ethical considerations include whether collecting, reporting on, and assessing values can harm people in any way (e.g. by revealing private information, being too invasive with research, omitting or undercounting the values of marginalized people, or transgressing sovereignty and self-representation). The effects of a valuation or assessment process on people can go well beyond the process, as it can influence decision-making and the resulting changes in nature and its benefits (cf. Step 6). Valuation thus has a distributional impact, in that some may win and others lose if decisions are made on the basis of its results.*
It is important to cover values of all relevant groups for an assessment. Therefore a helpful starting point would be to analyse what social groups are affected by land degradation and

[63] Text in italics summarizes the scoping step from Chapter 3.1, normal text gives indications how this might be specified in the example of an Assessment of land degradation in Africa.

restoration and how. When assessing different studies care should be taken to identify which social groups were included in any study used and which were not.

M. Broader social context. *Relational values are important elements in the valuation of nature and its benefits. Thus a scoping process must consider how methods take into account the nature of relationships between people across scales, including power relationships, material and spiritual relationships and interactions about people and nature, the distribution of incomes and resources as well as gains and losses, externalities, and reciprocal relationships. These considerations include persons not actively taking part in the valuation, especially future generations. Consideration of the broader social context includes how methods account for the effects of anthropogenic assets, institutions, governance, and other drivers on the values of nature and its benefits.*

Access to land and property rights, including management and use rights, often decisively influence the value formation concerning both degradation and restoration of land. Competing legal systems, e.g. formal and traditional law, de facto open access, and privatization of fragile lands that are better managed by large-scale rotation of areas used across different seasons, are not only important drivers of land degradation but also have direct implications for what communities can and cannot do to prevent degradation or start restoration, thus also influencing quite directly on the values people might attribute to different aspects, and the contributions to human well-being.

N. Practical considerations include the availability and need for resources (e.g. time, personnel, funding, equipment), knowledge, information and data (see Chapters 4 and 6). Different types of methods require different technical skills and tools, time and professional expertise.

Assessments usually are conducted under extremely tight timelines. In such cases the most important work regarding valuation refers to identifying types of relevant values, compiling what is available on them and then describing where there is evidence, where there are some indications of the importance of values but nothing conclusive and where there are gaps. Highlighting that decisions are currently taken without even indicative information on certain values at stake can be an important result regarding values in an IPBES assessment.

As an important part of Step 2 we suggest you use Table 2.1 in its expanded version table 5.1, and specify the types of paradigms and worldviews for a "Good Quality of Life" and accordingly the potential values at stake for the topic of the assessment. For each row the 'things of value' can be specified for the example at stake. Next, affected stakeholders and potential knowledge holders can be identified for each example. Based on this, methods or at least indicators as well as data or information sources can be identified and chosen. Most assessments will take "nature's gifts" into account but the importance for good quality of life might easily be left aside or summarized very briefly. The table can help to uncover more of the implications of losing specific aspects of biodiversity for good quality of life. We have indicatively filled the table (Table 5.1a.) to illustrate how this might be applied to land degradation. In some places implications already include significant migration, sometimes loss of entire cultures that can no longer survive on their traditional livelihood strategies that are deeply entwined with managing fragile ecosystems with significant parts of their culture and social systems directly depending on this as well. Effects of degradation are also often felt in areas quite remote from the degraded area itself, both downstream effects and sand storms are examples.

Step 3 Valuation

In an assessment context, this means first scanning the literature (including gray literature and all potential sources outlined in chapter 4) and to identify gaps. The expert group can then prioritize certain values for further analysis. Every assessment should provide a general overview of values at stake (including the paradigms and worldviews under which they have been studied), where gaps of current accessible knowledge are and explicitly indicating which ones have been prioritized and why. For possible data sets to consider see chapter 4.

Step 4 Integration and bridging

Often 'describing what is there and how important some values are in some contexts' will be an important first step. Beyond this, the policy context and how applicable the results are will determine the level of integration or bridging of the findings that can usefully be done. For example, values of the same ES found using different disciplinary methods may need to be reconciled, or at least the differences explained, for policy purposes. Even with the use of the same valuation method, values found at the scale of a study area need to be integrated or bridged for application. Where incommensurable values are being considered, the assessment needs, at least, to recognise that complexity, and if possible, indicate any practical ways of dealing with it. It is important to be aware that values under different paradigms and worldviews usually cannot be integrated, for example, monetary valuation under the Living-well in balance and harmony with Mother Earth.

Step 5 Reporting results

As indicated above, the first result of an assessment of values will be to provide an overview of potentially relevant values and a description of the knowledge available about them. The challenge is to make statements that are useful for policy even where little information is available. Case studies can be used to illustrate the significance of certain values in specific contexts. For example, in the case of land degradation, studies that illustrate causal chains of degradation, outmigration, break down of cultural traditions, importance of communal access and management rights and institutions etc. can be used to show what is potentially at stake, or has been lost, or could be recovered by timely restoration efforts, even if it is impossible to calculate exact values for all issues involved, let alone achieve complete coverage in spatial terms. When reporting results, care should be taken to contextualize what is known, to point to important gaps and highlight potential implications rather than only pointing to inconclusive evidence and the need for further studies. Creating awareness of the diversity of values at stake, which paradigms and worldviews are considered and which are not, the potential implications of a decline of nature's ability to provide these values for the quality of life and relational values within societies can be much more important than exact figures.

Results should also address different levels and contexts of decision making. Local rural managers are an example of one level. Relevant issues for them are how they perceive degradation and how they are directly affected, recommendations on how to safeguard some of the values that are of interest to them, and how they can integrate them in the management of their resources. However, many issues cannot be addressed at the local level and land degradation in many countries has become an important (sub)national issue when it has clear impacts on food production or leads to erosion and changes in sediment retention patterns, affecting reservoirs and coastal water quality or triggers significant outmigration. At the international level, the role of degradation and restoration is debated in the context of carbon stocks and uptake. Land degradation is becoming a global issue e.g. in the context of the reduction of emissions from deforestation and forest degradation (REDD+) and the ability of forests to store and uptake carbon and how these do not compensate for efforts focused on land use change, but also through sand storms transporting dust to neighbouring continents. In each of these contexts the values at stake, and recommendations how they might better be addressed differ significantly.

Table 5.1a Land Degradation

Focus of values	Types of values	Key targets of valuation	Examples of key 'things' of value, specified for LAND DEGRADATION	Key stakeholders, knowledge sources, expertise	Methods/approaches	Data & information sources
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	suffering or local extinction of animal species	local communities affected, specialised researchers and conservation specialists	qualitative, species loss can be quantified, biodiversity indexes and indicators (red list)	peer-reviewed literature
		Biophysical assemblages	Wilderness, ecosystem integrity, species right to exist, biodiversity at stake; Gaia, Pachamama, Mother Earth integrity may be lost	societies or peoples affected, indigenous and local leaders	qualitative, interviews, group discussions, deliberative processes, holistic and indigenous valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical processes	biogeochemical cycles, evolution, ecological resilience all are at stake	Government, local communities, researchers and research institutions	Both qualitative / quantitative	peer-reviewed literature
		Biodiversity	Reduced biodiversity (at least at species and functional levels	government, civil society, business people, local communities affected by degradation,	Both qualitative / quantitative, ecological assessments and indicators, ecological valuation	peer-reviewed literature

				specialised researchers		
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)	energy		biophysical & geochemical science	peer-reviewed literature results from modelling
			material flows		biophysical & geochemical science	peer-reviewed literature, results from modelling
			land and land properties		biophysical & geochemical science	peer-reviewed literature, results from modelling
	Instrumental	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people will decline with loss of soil stability and fertility and water quality and quantity	communities affected, specialised researchers, ILK holders	Indigenous and local people valuation	Networks and participatory approaches to support ILK knowledge and practice
	Anthropocentric	Nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning & cultural services)	Erosion and fertility decline, Sedimentation increases, climate regulations, water quality and quantity decline	local communities affected including downstream etc., governments of relevant regions and levels, soil and water scientists	Indigenous and local people valuation	Networks and participatory approaches to support ILK knowledge and practice
			decline in food	local communities	Market prices for	peer-reviewed

			production, loss of forest and forest products, decline in water availability	affected, governments of relevant regions and levels	production decline, even if for subsistence, production functions for water decline, time required for water or fuel collection	literature official statistics
	Relational		Loss of ecotourism opportunities, recreational options will decline (option/bequest values lost), specific knowledge of managing certain ecosystems can be at stake, loss of places that are spiritually important	local communities affected, governments of relevant regions and levels, national economy, ILK knowledge holders	Indigenous and local people valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
GOOD QUALITY		Security and Livelihoods	Food security, water security, livelihood security are at stake	communities affected	Livelihoods' assessments Indigenous and local people valuation	Peer review literature Networks and participatory approaches to support ILK knowledge and practice
		Sustainability and Resilience	social-ecological sustainability decline, in extreme cases outmigration can put	communities affected, ILK knowledge holders, specialists for integration, or coupled	Quantitative Deliberative processes	Peer review literature Networks and participatory

OF LIFE			more pressure on resources and infrastructure in the places people migrate to, Social resilience declines	system understanding	Holistic and indigenous and local peoples valuation	approaches to support ILK knowledge and practice
		Diversity and Options	loss of cultural diversity, diversity of options, may also lead to new ways of life, and how to manage the land	local communities affected, humanity, anthropologists and social scientists	Deliberative processes Holistic and indigenous and local peoples valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Living well in harmony with nature and Mother Earth	Management of systems of life to restore harmony with nature	societies affected, indigenous leaders, local communities and indigenous peoples	deliberative processes, holistic and indigenous valuation	networks and participatory approaches to support ILK knowledge and practice
		Health and Wellbeing	loss of medicinal plants, malnutrition, water quality can lead to health issues, incidence of several diseases increases, destitution in extreme cases	local communities affected, other communities might be affected e.g. as a consequence of inmigration, ILK knowledge holders	Ethnobotanical studies,	peer-reviewed literature networks and participatory approaches to support ILK knowledge and practice

		Education and Knowledge	Traditional knowledge on managing fragile lands/ecosystems,	local communities affected,	Ethnographic studies, Anthropological studies	
		Identity and Autonomy	Cultural identity of nomadic people may be at stake, way of life might change entirely, loss of sense of place, social cohesion, social capital	local communities affected, ILK knowledge holders, anthropologists, social scientists	Qualitative Holistic and indigenous valuation	peer-reviewed literature
		Good social relations	Social resilience declines	local/affected communities		Participatory mechanism for ILK
		Art and cultural heritage	Heritage values and future options are lost, e.g. loss of totemic species associated with cultural rites, but also specific skills.	local communities affected, future generations (who represents them?), ILK knowledge holders, social scientists, heritage organizations, e.g. museums,	Ethnographic, qualitative, some option values might be quantified	peer-reviewed literature
		Spirituality and Religions	totemic beings, species important to spiritual or religious practices, sacred sites	religious leaders,	Ethnographic, qualitative	peer-reviewed literature
		Governance and	groups depending directly on the land	communities affected, ILK knowledge	qualitative and	peer-reviewed

		Justice	become more vulnerable in extreme cases lose most of their assets and options, injustice/inequity increases	holders,	quantitative, needs to be disaggregated for different groups	literature

5.3. Pollination and Pollinators Associated with Food Production

Worldviews, values and perceptions are not absolute or static but change over time (i.e. past, present and the future) and space (i.e. local, regional, national, global). In the context of pollination, considering short term, local (individuals, families, communities) scales crop pollination is valued for its contributions to rural producers' livelihoods, and to local food security. Holistic, biophysical, socio-cultural and economic tools can be used to assess the species involved, their abundances and contributions to pollination and species survival, marginal contribution of pollinators to yield, to food security and the implications of yield and food security for sustaining rural producers' health and livelihoods. At the same level, in certain cultural contexts, pollinators are also valued for cultural reasons and are an integral component of the systems of life of nature. Socio-cultural approaches can be used to assess these values, their origin, and changes. At the global scale, pollinators are valued for their contribution to total food production for human consumption. A decline in the number of pollinators affects this service, resulting in huge economic losses. The search for natural or man-made alternatives to replace pollinator services may be expensive and inefficient in comparison. Holistic, economic and public health valuation approaches can be used to assess the benefits of pollination. Also, indigenous and local peoples valuation is an approach to consider in order to understand the role of pollination under different knowledge systems. Over many millennia at the global scale, pollinators are valued for their contribution to biodiversity and in sustaining inter species interactions. Biophysical approaches can be used to assess these values.

Table 5.1b, showcases the diversity of values that can play a role in the context of pollination depending on the object of value by including pollinators, ecosystems, plant and animal populations, biodiversity, and resilience. Among nature's benefits pollination, food, food security, recreational (urban gardening), landscape elements – sense of place, medicinal benefits and other ecosystems services related with pollination can be included. It is also important to emphasize the role of populations and communities and their impacts on these functions and services. Pollinators can be used as an example of the holistic management of systems of life where there are complex relationships and interactions between people and nature under different knowledge systems. These resources are tightly linked to world visions themselves, to livelihoods, and to cultural values associated to heritage or identity or traditional knowledge. Good quality of life in the context of pollination includes human health/nutrition, food security and justice in terms of access to resources and employment as well as identity, recreational, cultural, religious significance.

Several methodologies can be used depending on the target research areas. A mixed approach combining quantitative and qualitative methods is suitable for pollination assessment. A list of suitable methods for different topics follows. For economic values, benefit transfer methods; for health issues, public health valuation methods; for capturing complexity at different scales, integrated modelling as well as surveys and observation, participatory processes among different disciplines such as stakeholder dialogue, ethnography or focus groups are crucial tools to identify various values at stake. Q methodology can be used to quantify qualitative coding values such as spiritual values and cultural values. Literature review and content analysis are suitable to map existing values related with pollination decline. Holistic and indigenous and local knowledge valuation through deliberative process can provide a better understanding of the complex values underlying interactions between different groups of people in the context of pollination.

Table 5.1b Pollination and Pollinators Associated with Food Production

Focus of values	Types of values	Key targets of valuation	Examples of key 'things' of value, specified for Pollination	Key stakeholders, knowledge sources, expertise	Methods/ approaches.	Data & Information sources
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	Living beings, sentient beings, sacred or totemic beings, reverence for life Animal welfare of those whose lives are dependent on pollination.		qualitative, species loss can be quantified, biodiversity indexes and indicators	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Populations, communities, biomes, ecosystem properties and functions, Pachamama, Mother Earth		qualitative, species loss can be quantified, biodiversity indexes holistic and indigenous and local knowledge systems	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical processes	Evolution and ecological resilience		Qualitative Quantitative	Peer-reviewed literature Networks and participatory

						approaches to support ILK knowledge and practice
		Biodiversity	Endemism, genetic diversity, functional diversity, species diversity, Biodiversity of insects, bats and bees and flowering plants	Rural populations Urban populations Future generations	qualitative, species loss can be quantified, biodiversity indexes and indicators	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
NATURE'S BENEFITS TO PEOPLE	*Biophysical* *Instrumental* **Anthropocentric**	Biosphere's ability to enable human endeavour (energy, materials, land)	Maintaining populations depending on certain pollinators, that can be decisive for ensuring vegetation cover and land stability, particularly in semi-arid lands.			
		Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people	Current and Future generations	Qualitative and Quantitative Resilience frameworks	Peer-reviewed literature
		Nature's gifts, goods and services (actual services enjoyed,	Food production, medicinal remedies, health products	Communities, individuals Future generations	Qualitative and quantitative Anthropology, focus	Peer-reviewed literature

		regulating, provisioning, cultural)			groups, interviews	
	Relational		Bee-keeping, recreation (urban gardening), educational, inspiration	Communities, individuals Future generations	Qualitative and quantitative Anthropology, focus groups, interviews holistic and indigenous and local knowledge systems	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
GOOD QUALITY OF LIFE		Security and Livelihoods	Food security and livelihoods security.	Farmers, pollinators, animals, Current and future generations	Qualitative and quantitative Anthropology, focus groups, interviews holistic and indigenous and local knowledge systems	Peer-reviewed literature
		Sustainability and Resilience	Bequest value of pollination, Ecological, social, economic, social-ecological sustainability	Current and future generations	Sustainability frameworks such as transition theory, systems- analysis, DPSIR Deliberative processes	Peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity	Farmers, pollinators, animals, Current and future generations	holistic and indigenous and local knowledge systems	Peer-reviewed literature

		Living well in harmony with nature and Mother Earth	The role of pollination in the systems of life of Mother Earth	Communities and indigenous peoples	holistic and indigenous and local knowledge systems	Preliminary approaches and procedures for working with ILK
		Health and Wellbeing	Physical, mental, holistic health, keeping genetic pool resources			Peer review literature
		Education and Knowledge	Distributional justice (keeping pollination service can contribute) intra-generational equity	Current and future generations	Qualitative approaches such as political ecology, ethnography…	Peer review literature
		Identity and Autonomy	Cultural identity, religious and spiritual identity, sense of place.	Community and indviduals	Qualitative approaches, anthropology, tools such as narrative analysis, interviews holistic and indigenous and local knowledge systems	Peer review literature
		Good social relations	Community bonding	Community and individuals	Sociology and anthropology. Use of focus groups holistic and indigenous and local knowledge systems	Peer review literature
		Art and cultural heritage	Sacred sites Rituals, ceremonies	Pollinator dependent Community and	Sociology and anthropology. Use of	Peer review literature

				individuals	focus groups. Historical approaches to trace back cultural practices	
		Spirituality and Religions	Pollinators that belong to sacred sites, or are totemic beings, or on which such totemic beings depend			
		Governance and Justice	Global crops are pollinator dependent At a global scale: it affects food production At a local scale: it affects pollinator dependent societies, culture and farming practices are at stake	Community and individuals Global community NGOs: Pollinator Partnership,	Multilevel governance frameworks Philosophy and environmental politics. Political ecology	Peer review literature

5.4. Invasive species and their control

Even though biological introductions are as old as human migrations, they became a real concern in the mid-1980s, following the growth and intensification of economic, social and ecological damage related to invasions. Today, the study of and the fight against biological invasions are one of the most prominent issues in conservation biology. A whole discipline is developing, invasion biology, with a scientific society, several journals and whole research departments.

Biological invasions management situations are almost always the scene of a great diversity of heterogeneous and competing values and interests. Any manager or policy maker who wants to tackle invasion issues could benefit from an as accurate as possible overview of the values concerned.
There is a huge amount of literature on the ecological and economical valuation linked to biological invasion, for specific cases as well as at more global levels. A great diversity of qualitative studies on local perceptions, ethical issues, eco-ethnological impacts are also available and multiplying (cf: 2012 BIODIVERSA call - INVABIO).

Invasion biology is highly value laden. The scientific vocabulary itself is more than often normative (Larson 2005, Larson 2007). In biological invasions management issues, there is often much more than ecology and economics. It has to do with broader values and representations: a sense of identity, a way to consider a good and a bad biodiversity (e.g. some vernacular names given to invaders sometimes reflect a society's xenophobic opinions). It is thus crucial to pay a specific attention to values when dealing with biological invasion issues (whether for policy making or for managing purposes).

This kind of assessment will share all the challenges and difficulties mentioned in the general context. Special attention should be paid to the integration of public values in the assessment and the integration of very heterogeneous information.

Furthermore, a specific challenge for value assessments in the context of biological invasions is that it may be that some values at stake are either unconscious or willingly hidden and dissimulated under "so-called" objective statements about ecological or economic issues.

It should be noticed that most evaluations will have to assess a variety of the values presented in the table and thus will need mixed methodologies and multi-criteria analysis.

Invasive species strongly affect nature itself this part needs to be understood in order to better understand values at stake regarding nature's benefits and quality of life.

Table 5.1c Invasive species and their control

Focus of values	Types of values	Key targets of valuation	Examples of key 'things' of value specified for Invasive species			
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	The species existence (for instance when an endemic species is threatened by an exotic competing population). Some charismatic plants can be at stake in some exotic invasion issues and raise social concern for the individual plant themselves (example :Exotic trees in gardens or native trees threatened by an exotic		Minimum viable population analysis Preference assessment	Peer-reviewed literature Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Populations, communities, Evolutionary potential of the community		Minimum viable population analysis	
		Biophysical processes	The value of diversity for itself, Ecosystem integrity		Ecological assessment of the situation (demographic trend of the targeted species, ecological impact of the invasion…) Qualitative inquiries about the social perception of the issue at stake. Economic and	Peer-reviewed literature

					technical assessment of the impacts of diverse available control techniques (displacement, sterilization, killing…)	
		Biodiversity	Indigenous biodiversity - Endemism Global biodiversity Possible threat to local sterns		Global biodiversity mapping Global range of distribution mapping Mapping of global transportation means for exotic species (people, boats, seeds…)	peer-reviewed literature
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)			biophysical and geochemical studies	
	Instrumental	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people, nutrient cycling			Peer reviewed literature
		Nature's gifts, goods and	Regulating : Invaders often play an ecological role (positive or negative)			peer-reviewed literature

	Anthropocentric *Relational*	services (actual services enjoyed, including regulating, provisioning, cultural services)	Provisioning: A lot of exotic species are initially introduced because of their provision value Competition for aquaculture		Diverse ecological measures Biophysical modeling approaches	peer-reviewed literature
			Recreational: Educational virtue of some management programs that include civil society. Scientific value of "open field experiment" (Brown & Sachs 2004) Recreational value of easy birdwatching		Biophysical valuations Market-oriented valuations Sociological inquiries	peer-reviewed literature
GOOD QUALITY OF LIFE		Security and Livelihoods	The resilience of the ecosystem is affected by invasion Negatively (Kudzu, Nile Perch, etc.) Positively (e.g. when an exotic pollinator replaces an extinct native one)			
		Sustainability and Resilience	Bequest value of pollination, Ecological, social, economic, social-ecological sustainability Long delay between the invasion and its full effects Increasing costs with time Possible irreversibility of some invasions	Current and future generations	Sustainability frameworks such as transition theory, systems- analysis, DPSIR	peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity			
		Living well in harmony with nature and Mother Earth	The understanding of the balance between different ecosystems and cultural background challenged by invasion, and options for restoring the balance between peoples	Communities	Indigenous and local knowledge systems valuation	peer-reviewed literature Networks and participatory approaches to support ILK knowledge

						and practice
		Health and Wellbeing	The Fire Ants (Solenopsis invicta), in the South-East of US Emergent diseases (West Nile Virus)		Monetary valuations Participative economic valuations Deliberative valuations Public health valuation	Peer-reviewed literature
		Education and Knowledge				
		Identity and Autonomy	Biological invasions can crystallise some identity and nationalism feelings and discourses		Deliberative valuation Holistic and indigenous methods	Peer-reviewed literature
		Good social relations	Community cohesion, social resilience, conviviality.			
		Art and Cultural heritage	Inspiration, artistic creation.		invasions can be quite inspiring or increase aesthetic values	
		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being			
		Governance and Justice	Environmental justice, intra-generational equity, inter-generational equity...	Communities Current and future generations	Political ecology Deliberative valuation Holistic and indigenous methods	

5.5. Sustainable use and conservation of biodiversity and strengthening capacity and tools

The concept of sustainable use of resources is deeply ingrained in societies that continue to hold the worldview that humans should live in harmony with nature and Mother Earth. Such societies have evolved strong institutions (sets of beliefs, norms, taboos, laws and regulations) that deter their members from exploiting ecosystems and resources therein beyond limits that will affect their functioning and population or quality. Furthermore, - through a long and continuous interaction with nature and Mother Earth, such societies have a deep knowledge of the resources available, ecological cycles, appropriate harvesting or hunting period and utilization of the resource for various needs, including the spiritual relationship between peoples and nature. Stewardship towards nature or certain species is an important value in many societies and religions. With changes to environmental governance patterns and dominance of a prominent worldview focused on rational, positivist thinking, and a shift away from sustenance-based economies, the concept of sustainable use has entered the lexicon, meaning a rational use of the natural resources without undermining the capabilities of regeneration of natural resources. However, sustainable management of ecosystems, including use and conservation of biodiversity, appears to be a crucial aspect in different knowledge systems and not only in rational utility economy. Sustainable use and conservation of biodiversity is one of the challenges for all societies to interact with nature and Mother Earth thinking in future generations. Therefore, sustainable use and conservation of biodiversity can be analysed in the context of traditional and local knowledge systems, and as a way to make visible local efforts for managing ecosystems and nature sustainably for current and future generations, and taking fully into consideration the interaction between social, economic and ecological implications of the management of systems of life. This focuses on utilization of resources within sustainable limits and by implication also relate to the rights and responsibilities of various actors who have a stake in a resource or ecosystem function and service. It also relates to the rights of different actors to their various needs such as livelihoods, traditional territories, sense of place, access to production sites, sites of habitation, and various other ecosystem functions and services. Sometimes, the values held by different actors towards resources, functions, ecosystems and production systems vary and could result in conflicts. Some examples include the interaction of traditional values with new values imposed by public policies (eg., mixed cropping with monocropping; retention of farmland vs creating more urban areas); through the in-migration of people who do not attribute similar values to the biodiversity and ecosystems where they move into; or the demands on production patterns dictated by consumers from distant cities.

In the context of sustainable use and conservation of biodiversity, the values attributed to nature should emphasize the diversity of values depending on different worldviews and knowledge systems and should include anthropocentric and non-anthropocentric 'types of value', such as genetic, populations, species, community, type of ecosystem, species identity, species' functional characteristics, species' requirements. Among nature's benefits, all kinds of uses of biodiversity can be included, such as food, medicine, construction, decoration, and spiritual services. It is also important to emphasize the role of populations and communities and their impacts on these services. These resources are tightly linked to worldviews themselves and relational values, to livelihoods, and to cultural values associated with heritage or identity or traditional knowledge. For good quality of life, impacts of biodiversity and its sustainable use are linked to supplying resources to satisfy basic needs, income, security in terms of providing equity as well as a range of options, health in terms of medicinal plants, sustainable livelihoods, sustainable production and consumption patterns and sustaining the capabilities of regeneration of systems of life of nature. Several methodologies can be used depending on the target research areas. Biophysical approaches are needed to assess diversity of resources, population sizes and how they can be managed sustainably. Economic approaches are needed to assess opportunity costs, costs of management, net benefits and links to market prices. Public health methods assess the diverse human health effects from various domains (nutrition, infectious disease, non-communicable disease and mental health). Socio-cultural analysis provides various ways of understanding sustainability, resource use and conservation by analyzing tensions,

society's preferences, historical meanings as well as institutional challenges and opportunities. Holistic approaches, including indigenous and local knowledge systems, are needed to understand the role of this biodiversity in different worldviews and livelihoods from an integrated perspective, including the development of socio-economic and ecological systems. A mixed method, which combines these approaches, is suitable for IPBES assessments, or where available, studies and results from the different approaches mentioned should be considered in the assessments.

Table 5.1d Sustainable use and conservation of biodiversity and strengthening capacity and tools

Focus of values	Types of values	Key targets of valuation	Examples of key 'things' of value	Key stakeholders, knowledge sources, expertise	Methods/ approaches.	Data & Information sources
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	Sacred being (cannot be killed) reverence for large trees Issues related with hunting and harvesting Animal welfare reverences to the soul of hunted animals after Life	Hunters, harvesters Rural populations Urban populations Citizens Culture in general	Ethnographic, Ethnoecology History ILK systems	Books Book chapters Peer review literature Material art Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Sacred ecosystems, Pachamama, Mother Earth. Religious views			
		Biophysical processes	Evolution and ecological resilience			
		Biodiversity	Endemism, genetic diversity, functional diversity, species diversity, Biodiversity of insects, bats and bees and flowering plants			
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)	Energy extracted from the ecosystem Proportion of energetic needs provided by ecosystems	Urban populations Rural populations	Biophysical (e.g. energy analysis, ecological footprint, material flow analysis Economic	Global and regional databases Peer review literature Grey literature
			Total material consumption, life cycles, carbon footprint, water footprint...			

	Instrumental		Land cover flows, ecological footprint...		(market and non-market assessments	
	Anthropocentric	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people	Local to global level managers and policy makers	Quantitative and qualitative information Biophysical: indicators of ecological resilience Indigenous and local knowledge systems	Peer-reviewed literature

	Relational Nature's gifts, goods and services (actual services enjoyed, including regulating, provisioning, and cultural services)	Wild food sources, medicinal plants and animals, resources for ritual events, for arts and crafts	Hunters, Harvesters, Managers Policy designers Ecotourists	Quantitative and qualitative information Biophysical (amount of resources available Maximum sustainable use, Negative aspects of harvesting or sightseeing) Geographic (where are resources located) Deliberative (which species are preferred) Ethnoecological (which species are used and how) Economic (non-market assessments Indigenous and local knowledge systems Holistic valuation	Books Peer-reviewed literature Grey literature Global and regional databases

GOOD QUALITY OF LIFE		Security and Livelihoods	Food security and livelihoods security. Food sovereignty Institutional diversity Social cohesion TEK adaptive co-management	Hunters, Harvesters, Managers Policy designers	Biophysical (insurance value, demand vs. supply) Political ecology (who has access) Economic Indigenous and local knowledge systems	peer-reviewed literature, Norms, laws and agreements
		Sustainability and Resilience	Resources availability for today and into the future Social-ecological resilience of harvesting or hunting Precautionary principle Buffers against shocks	Current and future generations	Sustainability frameworks such as transition theory, systems-analysis, DPSIR Holistic valuation	Peer-reviewed literature
		Diversity and Options	Cultural diversity and biodiversity Biocultural diversity Local traditional knowledge Bequest value	Hunters, Harvesters, Managers	Biophysical (diversity of options) Ethnoecological (diversity of uses) Political ecology (diversity in access) Holistic and indigenous knowledge systems	Peer-reviewed literature Grey literature Material culture
		Living well in harmony with nature and Mother Earth	Relationships and interactions between people and nature inherently entwined as systems of life in Mother Earth; Stewardship of nature and resources …	Communities and indigenous peoples	Quantitative and qualitative information Deliberative processes Indigenous and local knowledge	Networks and participatory approaches to support ILK knowledge and practice Peer review literature

					systems Ethnography Sociology History	Grey literature Material culture
		Health and Wellbeing	Impact of sustainable use on Physical, mental, holistic health, keeping genetic pool resources Zoonotic diseases	Rural populations Urban populations	Nutrition Epidemiology Psychological health	Peer-reviewed literature Grey literature Global and regional databases
		Education and Knowledge				
		Identity and Autonomy	Cultural identity, religious and spiritual identity, sense of place.	Community and individuals	Qualitative approaches, anthropology, tools such as narrative analysis, interviews	
		Good social relations	Community bonding Community rituals		Sociology and anthropology. Use of focus groups	Peer-reviewed literature
		Art and cultural heritage	Sacred sites Artistic creation Inspiration		Anthropology	
		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…		Anthropology, religious texts and studies	
		Governance and Justice	Distributional justice future access to resources) intra-generational equity (equal access across gender socio-economic status, religion, ethnicity) Water grabbing, Land grabbing Virtual water	Current and future generations	Qualitative approaches such as political ecology, ethnography… Discount rate Ecological debt	

5.6. Guide to regional assessment:

A hypothetical example is used here to illustrate the application of the assessment protocol to a regional assessment exercise: the status of and changes to food security, biodiversity loss and biofuel crops in Southeast Asia.

Step 1: Purpose of the Assessment: The Assessment should help to make decisions on conservation and sustainable use of biodiversity for the region as well as enhancing knowledge about key drivers of biodiversity loss for a Good quality of life. It also aims to enhance understanding of values of biodiversity and ecosystem functions and services, land use options for this region including the consideration of systems of life of nature and Mother Earth.

Step 2: Scope of Assessment
Types of values to be considered/ captured, please see table 5.1e considering different paradigms and worldviews in the context of the IPBES Conceptual Framework.
Stakeholders/ Interest groups to be engaged

- Local communities & Representatives (farmers, indigenous peoples)
- NGOs working on conservation and equity issues
- Researchers/ Scientists
- National, regional and local governments.Business community
- Relevant Government officers (from Forest Department, Agriculture, Education, Tourism, Meteorology, Water resources, Environment, Energy, Health, Land)

Step 3: Valuation Context: This requires a mix of expert knowledge from formal and non-formal sources and literature review (please see table 5.1.e), including Indigenous and Local Knowledge Systems (ILK) and practices.

Step 4: Data sets that can be targeted

- FAOSTAT
- Landsat RS maps
- Socio-economic data from ADB, national data
- SEEA,
- IUCN data
- Asean Center for Biodiversity
- Literature surveys
- Sociological data surveys
- Participatory surveys, if required

Step 5: Choice of Methods and application

-Economic methods (Cost-Benefit)- for income, alternate land use, opportunity, livelihoods, food security

-Ethnographic/ Socio-cultural methods/ Holistic/ Indigenous methods: for systems of life and livelihoods, food security, self determination, rights to resources, territorial mapping, local priorities

- Biophysical methods: for agrobiodiversity, broader biodiversity, ecosystem functions and related (e.g. Remote sensing methods, species listing, ecosystem red listing)

- Public health methods: food security, health indices,

Step 6: Integration and Bridging of Results

- Perhaps Multicriteria analysis
- Deliberative methods

- For the regional assessment, a higher degree of aggregation of data will be required and broader range of ecosystem services have to be considered. Assumptions of transboundary co-operation need to be taken for site selection.

Table 5.1e Regional Assessment of status and changes to food security, biodiversity loss and biofuel crops in Southeast Asia (hypothetical example)

Focus of values	Types of values	Key targets of valuation	Examples of key 'things' of value	Key stakeholders, knowledge sources, expertise	Methods/ approaches.	Data & Information sources
NATURE *Intrinsic value*	**Non-anthropocentric**	Individual organisms	Species diversity (plants and animals) Issues related with hunting and harvesting Charismatic species (e.g., orang-utans)	Hunters, harvesters, indigenous peoples, Rural populations, citizens	Ethnographic, Ethnoecology Historical records	Books Book chapters Peer review literature Material art Participatory interviews or meetings, remote sensing maps. Networks and participatory approaches to support ILK knowledge and practice
		Biophysical assemblages	Mosaic landscapes, Communities and systems of life			
		Biophysical processes	Evolution and ecological resilience		Hydrological methods, soil science, population studies	Data Records, Maps, Networks and participatory approaches to support ILK knowledge and practice.
		Biodiversity	Endemism, genetic diversity, functional diversity, species diversity, Diversity of plants, animals and ecological complexes		Biophysical indicators	Records, remote sensing maps Networks and participatory approaches to support ILK knowledge and

						practice
NATURE'S BENEFITS TO PEOPLE	*Biophysical*	Biosphere's ability to enable human endeavour (energy, materials, land)	Energy extracted from the ecosystem Proportion of energy needs provided by ecosystems	Urban populations Rural populations Importers	Biophysical (e.g. energy analysis, ecological footprint, material flow analysis Economic (market and non-market assessments	Global and regional databases Peer review literature Other literature
			Total material consumption, life cycles, carbon footprint, water footprint...			
	Instrumental		Land cover flows, ecological footprint...			
	Anthropocentric	Nature's ability to supply benefits (basis of benefits)	Resilience of the supply of nature's benefits to people	Local to global level managers and policy makers	Biophysical: indicators of ecological resilience	Peer-reviewed literature
	Relational	Nature's gifts, goods and services (actual services enjoyed, regulating, provisioning, cultural)	Wild food sources, medicinal plants and animals, resources for ritual events, for arts and crafts	Hunters, Harvesters, Managers Policy designers Ecotourist	Biophysical (amount of resources available Maximum sustainable use Negative aspects of overharvesting, land use change, monocropping) Geographic (where are resources located) Deliberative (which species are preferred)	Books Peer-reviewed literature Other literature Global and regional databases Networks and participatory approaches to support ILK knowledge and

					Ethnoecological (which species are used and how) Economic (market and non-market assessments Indigenous and local knowledge	practice
GOOD QUALITY OF LIFE		Security and Livelihoods	Food security and livelihoods security. Food sovereignty Health security Income Institutional diversity Social cohesion TEK adaptive co-management	Hunters, Harvesters, Managers Policy designers	Biophysical (insurance value, demand vs. supply) Political ecology (who has acces) Economic (market and non-market) Indigenous and local knowledge	Peer-review literature Norms, laws and agreements Networks and participatory approaches to support ILK knowledge and practice
		Sustainability and Resilience	Resources availability for today and into the future Social-ecological resilience of harvesting or hunting Precautionary principle Buffers against	Current and future generations	Sustainability frameworks such as transition theory, systems- analysis, DPSIR	Peer-reviewed literature

			shocks			
		Diversity and Options	Cultural diversity and biodiversity Biocultural diversity Local traditional knowledge Bequest value	Hunters, Harvesters, Managers	Biophysical (diversity of options) Ethnoecological (diversity of uses) Political ecology (diversity in access)	Peer-reviewed literature Grey literature
		Living well in harmony with nature and Mother Earth	Relationships and interactions between people and nature inherently entwined as systems of life in Mother Earth; Stewardship of nature and resources	Indigenous peoples, local communities	Quantitative and qualitative information Deliberative processes indigenous and local knowledge	Peer-review literature Grey literature Networks and participatory approaches to support ILK knowledge and practice
		Health and Wellbeing	Impact of sustainable use on Physical, mental, holistic health, availability and sustenance genetic pool resources Zoonotic diseases	Rural populations Urban populations	Nutrition Epidemiology Psychological health	Peer-reviewed literature Grey literature Global and regional databases
		Education and Knowledge	Persistence of knowledge on use of resources, sustainable harvesting, sites for study, inspiration	Community, Individuals, researchers, Local Government,		
		Identity and Autonomy	Cultural identity, religious and spiritual identity, sense of place.	Community and individuals	Qualitative approaches, anthropology, tools such as narrative analysis, interviews	Peer-reviewed literature Networks and participatory approaches to

						support ILK knowledge and practice
		Good social relations	Community bonding Community rituals		Sociology, anthropology. Use of focus groups	Peer-review literature Networks and participatory approaches to support ILK knowledge and practice
		Art and cultural heritage	Sacred species Sacred sites Artistic creation Inspiration		Ethnographic studies, Anthropology	Images, Ceremonies, Art
		Spirituality and Religions	Sacred sites, totemic beings, spiritual well-being…			
		Governance and Justice	Distributional justice (future access to resources) intra-generational equity (equal access across gender socioeconomic status religion ethnicity) Equitable access to various resources	Current and future generations	Qualitative approaches such as political ecology, ethnography Discount rate Ecological debt	Peer-reviewed literature

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Chapter 6: Capacity building

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Capacity building is a key component of IPBES' work programme for 2014-2018. Two deliverables aim directly to promote and support capacity building: priority capacity building needs to implement the Platform's work programme matched with resources through catalyzing financial and in kind support (deliverable 1a) and capacities needed to implement the Platform's work programme developed (deliverable 1b). Beyond these, however, all other activities critically depend on matching identified needs and gaps with available resources, and mobilizing new resources.

In the context of Deliverable 3(d), capacity building is intended to support and enhance the assessment and articulation of diverse conceptualization of multiple values of nature and its benefits, ultimately aiming to improve the integration of these values in planning and decision making for biodiversity and ecosystem services. We have considered below three priority areas for capacity building, together with examples of crosscutting activities to address them.

6.1. Identifying and prioritizing capacity building needs

The three priority areas identified in this session refer to (a) the capacity for generating data and information, (b) the capacity to carry out valuations / assessments, and (c) the capacity to influence policy and decision making/planning. For each of them, several lines of actions have been proposed in the following table.

Capacity building needs	Target audience	Lines of actions for capacity building
A. Capacity for generating data and information	Multi-disciplinary experts, municipal and local government, NGOs, private sector, university and research centers	● Increase access to / visibility of existing knowledge, including 'grey literature' and indigenous and local knowledge (ILK) where appropriate, e.g. by identifying existing sources of information, engaging with different types of expertise, and facilitating interlinkages between existing data repositories and networks of practitioners. ● Mapping of existing sources of information and development of an electronic portal that facilitates access to this information network ● Ensure better use of electronic / web-based tools for data sharing and collaboration. ● Conduct a strategic review of existing information base on capacity building needs available within biodiversity related Conventions and MEAs (e.g. CBD, Ramsar Convention), national strategies (for example NBSAPs) and other sources. ● Define procedures for the identification and meaningful involvement of relevant stakeholders, particularly holders of local and indigenous knowledge and under-represented categories (young people, practitioners from developing countries, disenfranchised groups).
B. Capacity to carry out valuations / assessments	Multi-disciplinary experts, municipal and local government, NGOs, private sector, university and research centers	● Increase capacity to carry out and use national and regional assessments, notably through early involvement of policy makers in scoping, coordinating, reviewing and uptake of assessments. ● Increase training capacities for interdisciplinary and transdisciplinary competences (major obstacle for the integration of existing or new knowledge of different types and from different sources). ● Include capacity building assessments within regional and thematic assessments processes to be conducted under IPBES framework. ● Clearer guidance on integrating ILK into scientific analysis and policy making (also taking into account experiences from other initiatives such as td-net (Network for Transdisciplinary Research in Switzerland).
C. Capacity to influence policy & decision making /planning	Government, Experts, Universities, civil society, resource managers	● Better connection of scientific and policy actors, exchange of knowledge on needs and existing expertise on both sides. ● Tailored information/training on how to interpret and use assessment results. ● Improve the capacity to locate and mobilize financial and technical resources through effective communication, training and the creation of a network of information and fund-raising volunteers.

6.2. Examples of crosscutting activities to address capacity building needs

6.2.1. Identifying and mobilizing additional financial support

Financial support, including technological support, is a key precondition for addressing the capacity needs identified above, taking into consideration the financial constraints in many of the developing countries. Mobilization of the resources should consider the following actions:

- Identifying regional, national and local priorities and constraints in mobilizing capacity building support, including technological support.
- Ensuring that the match-making tool is flexible enough to facilitate match-making for different needs and types of stakeholders (different user-specific modules, advanced search facility etc.).
- Strengthening the operational capacity of the secretariat, including creating an advisory capability on capacity building for articulation of multiple values of nature.
- Facilitate the match between actors who have a capacity building need related to the agreed IPBES work programme with those able to help meet that need, while avoiding duplication of efforts.
- Mobilizing professional support from advertising agencies, fund raisers and other stakeholders with relevant expertise.
- Increase capacity for stakeholder involvement, among others through clear and impartial procedures on equal and fair access, and address possible power imbalances and vested interests.

6.2.2. Fellowship, exchange and training programmes

Knowledge exchange and training programmes have a significant multiplier effect for diffusing research results and building capacities in various sustainable development areas including biodiversity and ecosystems. Actions to be taken in this dimension include:

- Clarifying the eligibility criteria, application procedure and available resources for each type of action (fellowships, exchange programs, secondments, training programs, mentoring schemes).
- Prioritize inter-regional mobility, and facilitate exchange and flow of expertise, taking into account differences in capacities and infrastructure between regions.
- Provide opportunities for the training of trainers for capacity building assessment.
- Develop thematic or user-specific e-learning materials to support education and training activities.
- Consider the potential of ICT-based training, including MOOCs, to support or complement face-to-face training and mentoring activities.
- Develop a communication strategy adapted to the needs of different user groups (e.g. young professionals, researchers, trainers).

6.2.3. Facilitating science-policy networks, platforms and centres of excellence

Capacity for communication and networking could be developed for the science-policy aspects of biodiversity and ecosystem services evaluation. Efforts in this area should be made to:

- Develop an inventory of existing networks and areas of possible collaboration (north-south and south-south), including specific strengths and areas of expertise of different actors (e.g. training, communication, fund raising, networking).
- Facilitate communication within the IPBES community (including member states experts, national focal points): exchange of information and good practices through regular meetings, online forums, match-making facility etc.
- Identify and make use of formal and informal (or semi-formal) science-policy mechanisms and communities of practice established at subnational, national, regional or interregional level.
- Increase efficiency of knowledge sharing and use through better networking with other initiatives / avoiding replication of tasks and efforts.
- Connect with other existing mechanisms (especially CBD, UNCCC) for exchange of expertise and mutual support on capacity building.
- Make use of existing platforms, resources and tools (Sub-Global Assessment Network, IPBES' catalogue of assessments, UNCCD market place and CBD LifeWeb etc.).

Facilitate the involvement of national and regional centres of excellence and science-policy platforms, inter alia through clearer identification/selection procedures and better communication on existing needs and priorities.

Chapter 7: Policy Support Tools, Methodologies and Instruments for the Diverse Conceptualization and Assessment of the Multiple Values of Nature and its Benefits

7.1. Introduction

A near-term IPBES deliverable is a guidance document on how to implement the mandate of the IPBES with regard to the policy support function and the development of a catalogue of policy support tools and methodologies, including those relevant for "the diverse conceptualization and assessment of the multiple values of nature and its benefits, including biodiversity and ecosystem services". In this regard, each peoples' worldview must be able to develop its own policy support tools, according to their particular view of the "Good quality of Life" including that of the Living-well in balance and harmony with Mother Earth. Therefore, any assessment of the multiple values of biodiversity and ecosystem services should use the guidance document and catalogue when assessing policy tools and methodologies.

The guidance document and catalogue identifies and assesses the availability, effectiveness, practicability and applicability of a wide range of policy-relevant tools and methodologies, recognizing they are needed for different purposes at different stages of the policy cycle. The catalogue will be a dynamic online platform designed to meet the end-users needs, including for experts conducting IPBES assessments.

Policy support tools and methodologies are approaches and techniques based on science and other knowledge systems that can inform and assist policymaking and implementation at the local, national, regional and international levels to protect and promote nature, nature's benefits to people and a good quality of life (figure 1).

Figure 1: Schematic representation of the context of policy support tools and methodologies

The guidance document and catalogue of policy tools and methodologies addresses each of the boxes and arrows of the IPBES Conceptual Framework, including those boxes and arrows most relevant to those associated with the multiple values of nature and its benefits to people, i.e., boxes on "Natures Benefits to People" and Good Quality of Life".

Policy support tools, methodologies and instruments need to be understood in the context of policy cycles and socio-ecological challenges at different spatial scales and what can be done to understand them.

7.2. Policy cycle

Policy making is a process to address a societal challenge. Adaptive Management (AM) proposes policy making as a deliberate 'experiment', emphasizing iterative cycles to ensure an envisioned outcome. A policy cycle then consists of envisioning, assessing, planning, implementing, monitoring and adjusting to vision. This approach is often associated with adaptive ecosystem management, but adjustment of values can be included. Participatory processes can contribute to AM. This approach reduces the risk of unintended consequences that can become clear after a delayed period of time.

7.3. Scale matching

Policy and decision making regarding biodiversity and ecosystem services are rarely confined to a single scale. The flow of value related information should be facilitated between local, national and global levels of scale. Appropriate scales of decision making can respond quickly and efficiently, and are able to integrate across scale boundaries.

7.4. Policy tools and methodologies

The catalogue identifies a range of families of policy tools and methodologies:

(i) Assembling data and knowledge, e.g., long-term ecological and socio-ecological research and monitoring (LTSER-sites);
(ii) Assessments and evaluation, e.g., multi-criteria analysis and cost-benefit analysis;
(iii) Public discussion, involvement and participatory processes, e,g., public hearings and government established commissions;
(iv) Selection and design of policy instruments, e.g., protected areas, payment for ecosystem services schemes; systems of life of Mother Earth;
(v) Implementation, outreach and enforcement, e.g, ecosystem-based management tools;
(vi) Capacity building; and
(vii) Social learning, deliberative processes, innovation and adaptive governance, including the assessment of the role of collective action of indigenous peoples, local communities, and local resource users.

Intercultural dialogue or the dialogue among different stakeholders is important to be considered in all of the above categories

7.5. Context for envisaging Policy Instruments

Policy support tools and products have to be viewed in three contexts, according to different peoples' worldview of the IPBES Conceptual framework.

- **Policy** – in the form of policy failure (failure of the government policy to correct externalities, i.e. the policy does not address the issues of both positive and negative externalities in the system). When subsidies and incentives do not achieve a desired effect of the policy. Taxes do not curtail pollution and incentive does not promote renewable energy use. e.g., Distortionary Subsidies, taxes, tariffs, regulations, quotas, and many other policy interventions, inefficient taxation of economic rent.

- **Market** – in the form of market failure when the allocation of goods and services by a free market is not efficient leading to pollution and external benefits. The equilibrium market prices fail to reflect the true social costs and benefits of resource use, the outcome is not Pareto efficient, e.g. Environmental externalities: Traffic congestion, climate change, Public goods, cost of damage, treatment.

- **Institutional** – organizations and collective action to manage natural resources are weak, distorted or completely absent, e.g. absence of secured property rights; institutions and legal structures do not exist-property rights in the case of open access or common-pool resources such as grazing grounds, communal forests, or coral reefs. Policy and institutional failures usually result in market failure.

Some views, such as the Living-well in balance and harmony with Mother Earth (see IPBES Conceptual Framework) do not consider that market instruments are appropriate policy tools for strengthening ecosystem functions and services.

7.6. Categorization of policy instruments

Policy instruments can be categorized in five main categories: (i) economic instruments and fiscal incentives; (ii) rights based, institutional and legal instruments; (iii) social and cultural instruments; (iv) standards and planning; and (v) Systems of life of Mother Life. These need to be considered in combination, if appropriate, and according to different national circumstances and priorities. These different categories should be applied in concordance with different peoples' worldviews, and in that context not all of them can be combined, since for instance, economic instruments can be contradictory to rights-based approaches. In addition, market mechanisms can only work if supporting institutions are in place, thus there is a need to build capacity to enable the more widespread use of these mechanisms, and the equity and distributional issues associated with each policy instrument need to be carefully assessed, e.g., the impact on poor people of eliminating subsidies.

(i) **Economic and Financial Instruments** Economic instruments are ways of enhancing governments' capacity to deal with environmental and development issues in a cost effective manner, promoting technological innovation, influencing consumption and production patterns, as well as providing an important source of funding. They include removal of distortionary subsidies, payment for ecosystem services, securing property rights, pollution taxes, user charges, tradeable emission permits, and refundable deposits that aim to correct market failures and reinstate full-cost pricing. Financial Instruments, in contrast, are often extra-budgetary and financed from foreign aid, external borrowing, debt for nature swaps etc. In the context of the IPBES, the implementation of market mechanisms must not mean that the commodification of environmental functions is promoted.

(ii) **Rights-based and legal Instruments** Rights based instruments enhance the conservation and protection of nature based on the recognition of rights of peoples and of Mother Earth. The definition of rights, usually through enacting specific laws and regulations, or strengthening institutions for their practical implementation at different levels, include the achievement of positive relationships between the protection of environmental functions, the development of sustainable production systems, and peoples' access to basic needs. The strengthening of rights, through laws and institutions, including quantitative limits on resource use, and supplement these restrictions with rights of access or usage e.g., the approach of the systems of life of Mother Earth including legal frameworks for the recognition of the rights of Mother Earth as complementary to the rights of peoples, including collective rights of indigenous peoples and local communities.

(iii) **Social and cultural**: Social instruments are non- market-based, awareness based voluntary interventions which are (a) information related instruments like environmental education, eco-labelling, pollutant release and transfer registers, biodiversity registers, awareness raising (including award schemes) / information dissemination/ Community right to know; (b) self-regulation/ voluntary agreements/ corporate social responsibility/ buyer-supplier relations; (c) participation (social pressure, worshipping etc. (d) enhancement of collective action of indigenous peoples, local communities, and local resource users.

(iv) **Standards and planning**: Standards are the tools for an organization to keep aware of the interactions that its products and activities have with the environment and to achieve and continuously improve the desired level of environmental performance. Example include ISO 14001 (International Standards Organization, Geneva, Switzerland), EMAS, (Eco-Management and Audit Scheme) in Europe. Planning might be in the form of an Environmental Management Plan (EMP) which outlines programs of actions which have been identified as part of the Environmental Management System (EMS). These are required as part of due diligence and compliance with environmental legislation and regulations and would require safeguard planning (e.g., World Bank safeguard policies) and adoption and implementation of the Equator principles. Also, it includes participatory mapping techniques and participatory planning.

(v) **Systems of life of Mother Earth:** The proposed management of systems of life of Mother Earth is operationalized through the following three interrelated actions:

- Characterization of systems life, considering the relationship between ecosystems and peoples (sociocultural entities) living in a given territorial jurisdiction. This concept can be interpreted in multiple scales (e.g. local, regional, and national).
- Agreements of complementarity with Mother Earth, which constitute a commitment among public, community and private actors in a given territorial area, showing compliance with respect to the rights of peoples and of Mother Earth, and addressing a set of objectives and goals oriented to the integral and sustainable management of ecosystems.
- Harmonization of systems of life, which are composed of a bundle of actions for strengthening harmonious relations among systems life and for restoring systems of life in areas where the balance between peoples and nature has broken or undermined.

7.7. Supporting policy makers

Findings of assessments are often underutilized within the policy drafting space. Whilst there are multiple reasons for this, the lack of interaction and the lack of relationships between policy makers and research, and ineffective communication between these groups are often confounding / driving factors. For critical results to reach the policy space these relationships need to be established, interaction is required at a

personal level where trust is developed, as well as shared understanding generated around both valuation methods and results. Once trust is established numerous interventions and products which contain valuation information / knowledge can be purposefully assembled to provide appropriate information and support to the policy maker. It is crucial that policy makers are part of the creation processes (co-creators), and where possible, the use and adoption of current tools and mechanisms should be encouraged. Some tools that have been found to be useful are listed below:

- Annotated presentations that policy makers can extract information from and use;
- Maps and mapping products;
- Dissemination of legal frameworks; e.g. laws of rights of Mother Earth and indigenous peoples;
- Technical data and spatial information available on shared portals;
- Hard copy maps and resource atlases;
- Electronic PDF's with linked information tables on values;
- The development of guidelines;
- Summary documents, brochures and communication tools;
- Case studies grounded in science that demonstrate / highlight specific values;
- Portals that provide and enhance access to information and act as repositories must be established;
- Training support tools (educating policy makers), e.g., the use of Webinars, YouTube clips and TED talks – made locally available.

Appendix 1: Business valuation approaches

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Biodiversity and ecosystem services (BES) valuation may be undertaken for different business purposes, depending on whose needs and aspirations it aims to satisfy (e.g. internal versus external stakeholders). It may use a combination of qualitative, biophysical and / or economic values.

Two complementary approaches are being explored. On the one hand, existing environmental and sustainability tools are being improved, in terms of production, information systems for decision-making and engaging external stakeholder levels (Houdet et al., 2012; Natural Capital Coalition 2014; Waage and Kester, 2014). These include impact assessment, mitigation and offset measures, biophysical assessments (e.g. GHG Protocol, Water Footprint Standard), environmental management, management and financial accounting systems, life-cycle assessment methodologies, product or service certification schemes, and sustainability reporting guidelines (e.g. Gilbert et al. 2011). In particular, environmental management accounting (EMA) is receiving increasing attention (e.g. Schaltegger et al., 2010). EMA is broadly defined as the identification, collection, analysis, use and coupling (e.g. eco-efficiency indicators showing provisioning services use per dollar unit of sales) of two types of information for internal decision-making (Jasch, 2009; UNDSD, 2001), namely (a) monetary information on environment-related internal and external costs and benefits; and (b) biophysical information on the use, flows and destinies of energy, water and materials (including waste).

On the other hand, various organizations have been developing tools that focus on assessing biodiversity and ecosystem Services (BES) (Waage and Kester, 2014; WBCSD 2013). There are those which aim to raise awareness about BES values, risks and opportunities (i.e. materiality analysis ; e.g. ESB — Ecosystem Services Benchmark, ESR — Ecosystem Services Review, BBII — Business & Biodiversity Interdependency Indicator), those used for finer-scale assessments at the land asset level (e.g. EROVA - Environmental Risk, Opportunity and Valuation Assessment, EcoAIM—Ecological Asset Information Management; EcoMetrix; Wildlife Habitat Benefits Estimation Toolkit), and those for finer-scale assessments for specific business perimeters / scopes for internal management (e.g. WBCSD 2012, Houdet, 2012) or external reporting purposes (e.g. Danish Environmental Protection Agency 2014; Houdet et al., 2010; Huizing and Dekker, 1992; OTTO Group, 2013; PUMA 2010).

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